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assembly & fastener ENGINEERING

SEPTEMBER • 1960

How Lubrication Affects Bolt Torque

Also in this issue:

Assembling Two-Cycle Engines at McCulloch
Selection and Use of Adhesives—Part 2
Glossary of Fastener Terms Near Reality

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September, 1960 Volume 3, Number 9

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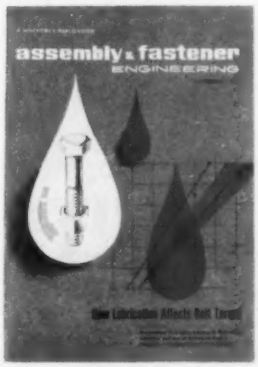
• Following extensive testing, Convair reports that consistent torque values can be achieved with lubricated bolts, but there is a wide variance with unlubricated bolts. For details of their study, turn to page 36.



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Letters to the Editor

Strength of Screw Threads

As the designers and engineers in our department have found the article, on "The Strength of Screw Threads" (June 1960), quite interesting, we would like to have a few reprints on hand to meet their requests.

F. J. Fennessy, Supervisor
Equip. Dev. & Standardization
Pratt & Whitney Aircraft
East Hartford, Connecticut

• Reprints of this article are available upon letterhead request.

Robot on the Assembly Line

Back in your January issue was a story on page 16 entitled, "Look for the Robot on the Assembly Line". Is more information available?

J. J. Kennedy, Senior Engr.
Western Electric Company
Chicago, Illinois

• Contact the Robodyne Division of U.S. Industries, Inc., Silver Spring, Maryland.

Welding Stainless Steel

We would appreciate receiving two reprints of the article, "Resistance Welding Stainless Steel", as it appeared in your June issue.

Evelyn Chambers, Librarian
Micro Switch Division
Minneapolis-Honeywell Regulator Co.
Freeport, Illinois

Please send a copy of this article to my attention.

Raymond Cavanaugh
Design Engineer
The Budd Company
Philadelphia, Penna.

Could we get several reprints of this article?

S. Roberts, Supervisor
Drafting Standards
Otis Elevator Company
New York, New York

• Reprints of this article will soon be available to all interested readers.

Cheap Fasteners?

One of the most important articles to our industry, that I have seen in a long time, was the one, "Cheap Fasteners? Are you Kidding?", in your August issue by Edmond C. Crowther of Shakeproof.

The fastener industry is always under severe competitive pres-

continued

ONE PIECE
locking insert

SLIMSERT* ... WRENCH IN and SWAGE OUT TOP to complete the simple installation of SLIMSERT inserts after hole preparation with standard drill and tap.

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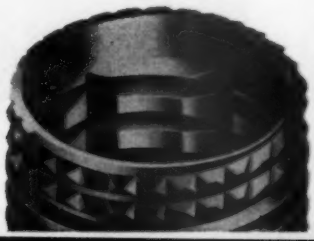

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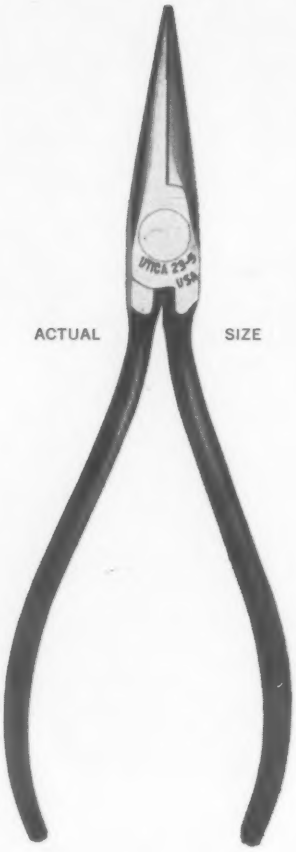

NEW MIDGET CHAIN NOSE!

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Utica Drop Forge & Tool Division, Kelsey-Hayes Company, Utica 4, N. Y.

tools the experts use!

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sures, but it seems to me that it is vital to the survival of the United States to maintain a strong fastener manufacturing industry.

It is extremely dangerous to weaken our industry by trying to save pennies on fasteners as pieces of metal, when dollars can be saved through closer technological teamwork between fastener users and fastener manufacturers.

Frank Masterson, President
Industrial Fasteners Institute
Cleveland, Ohio

Bonding Metal to Glass

Regarding the article on "Bonding Metal to Glass with Epoxy Cement", on page 25 of your July issue, we would like additional information.

J. F. Goodwin, Engineer
Douglas Aerophysics Lab.
El Segundo, California

• Further information is available from the Smooth-On Mfg. Co., 51 Harrison Ave., Jersey City 4, N.J.

Electronic Welding Control

Regarding the article, "New Controls Aim at Quality Spotwelds", on page 23 of your July issue, we would like to have more information on this Monautronic V-2 device.

Paul Black
Industrial Engineer
General Time Corporation
Athens, Georgia

• Further information is available from the Electronic Controls Section, The Budd Company, 2450 Hunting Park Ave., Philadelphia 32, Pa.

Hydrogen Embrittlement

We would appreciate receiving two or three copies of the article, "Hydrogen Embrittlement in Fasteners", which appeared in your July issue.

Jan Boers
Engineering Department
Owatonna Tool Company
Owatonna, Minnesota

I would appreciate receiving a reprint of the article, "Hydrogen Embrittlement in Fasteners".

C. E. Foertmeyer
Aircraft Nuclear Propulsion Dept.
General Electric Company
Cincinnati, Ohio

• This article is included in report No. 320 which is available from the SPS Laboratories, Jenkintown, Pa.

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Research & Development Division break-through in continuous warm forming...

*Thermo-Forged SOCKET SCREWS

The most dramatic innovation in socket screw manufacture in 28 years!

NOW, at last, after years of intensive research, Holo-Krome breaks the warm forming barrier with its revolutionary new electronic THERMO-FORGED process.

The first major break-through in socket screw manufacture since Holo-Krome pioneered and patented *Fibro-Forging* 28 years ago, Holo-Krome's unique new THERMO-FORGED process is *the first continuous, high-speed warm forming technique to be perfected!*

This revolutionary process *pre-conditions* the metal in patented apparatus for near-perfect forging conditions—by creating *just-the-right ductility* for the precise flowing of metals.

It gives Holo-Krome complete and continuous control and mastery over heat—and at unusually high speeds!

New and far higher standards in quality, precision and uniformity are now attained with Holo-Krome's exclusive THERMO-FORGED process. This unique process produces socket screws near-perfect in structure and of a uniform accuracy and quality never before possible!

Thoroughly researched in the laboratory and field-tested for more than two years, Holo-Krome's THERMO-FORGED Socket Screws are now available to industry through H-K's nationwide corps of authorized industrial distributors.

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Thermo-Forged*
SOCKET SCREWS

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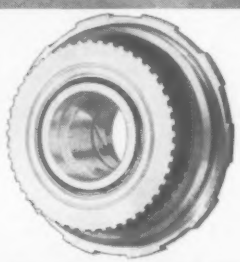
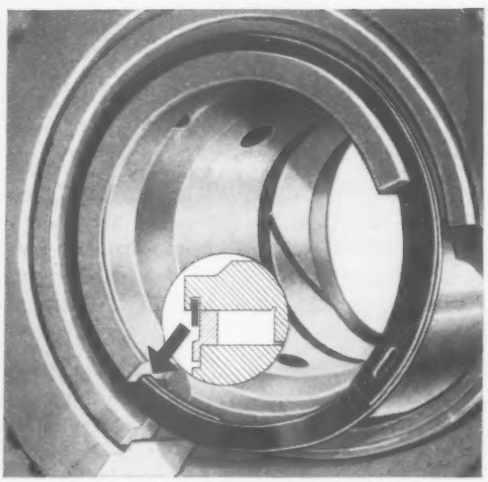
tOtal 2 gives you the Superior Solution!



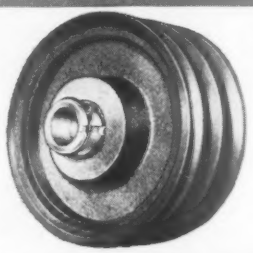


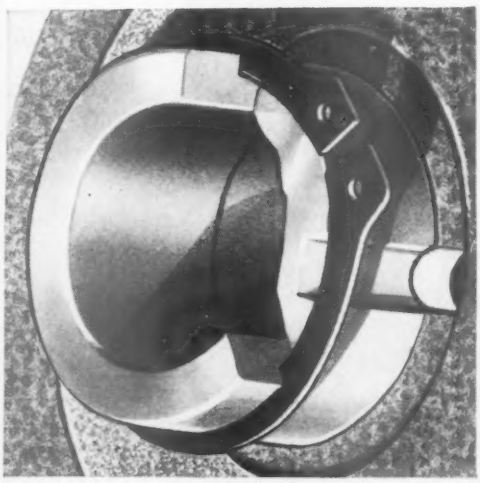
SpirOlox

was the Superior Solution to this application

This unique Ramco design, full-circle 360 degree retaining ring opens up unlimited possibilities for improved design and economies in thousands of new or present products. Check these outstanding features:

- √ Uniform wall allows installation with minimum clearance.
- √ Two turn, full-circle design eliminates gaps.
- √ No special tools needed for installation or removal.
- √ No tooling needed for prototypes.
- √ Develops "friction lock" under load.
- √ Single or multi-turn designs available.
- √ Always uniform in quality.
- √ Special designs for high-speed or tolerance stack-up problems.





CircOlox

was the Superior Solution to this application

This Ring provides the answer to easy, lightweight, low cost assemblies and reduced manufacturing costs. Made in a variety of types and sizes for the smaller shaft or housing diameters. Check these Circolox features:

- √ "Deep-groove" design permits maximum thrust with minimum weight.
- √ Easily installed or removed.
- √ Available in a variety of materials.
- √ Wide choice of finishes available.
- √ Always uniform in quality.
- √ Meet Government and Industry Standards.

Best proof that there are two sides to every story is contained in Ramsey's new tOtal 2 Retaining Ring Brochure. This novel two-sided Brochure shows you why it pays to have *both* modern types of retaining rings available to solve your particular problems... to give you the Superior Solution.

Ramsey's tOtal 2 gives you a choice of *both* modern types of retaining rings to help you increase product performance, improve appearance and reduce assembly costs. Ramsey is the only retaining ring manufacturer who can offer the advantages of the tOtal 2 retaining ring lines.

Your Ramsey Distributor will be glad to bring you *both* sides of the retaining ring story and show you how the tOtal 2 can give you the Superior Solution to your fastening problems. Use the coupon below to bring the new Ring Brochure and free copies of the new Retaining Ring Engineering Manual and complimentary subscription to our Technical Bulletin Service. Ask for free sample rings.

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FASTENOMICS

TIPS ON FASTENER APPLICATIONS BY **STANSCREW**

Socket Head or Hex Head Cap Screws? It All Depends on the Application

In selecting a Cap Screw, the conditions of a specific application may make the Socket Head, the Heat-Treated Hex Head, or the Bright Hex Head an obvious choice for greatest economy and most satisfactory performance. Stanscrew provides all three varieties, and we will attempt to point out the relative advantages of each.

Two Basic Differences

The essential differences between the three types of fasteners are their relative strengths and the conformations of the heads. In addition, the general appearance of the product will sometimes indicate using a particular fastener.

How Do Strengths Compare?

The table below gives the relative tensile, shear, and usable strength in tension of all three types of fasteners. The usable strength has been calculated based on the average pre-stressing of the fasteners to 80% of minimum yield strength.

SIZE	SOCKET HEAD CAP SCREWS			HEAT-TREATED (SAE Grade 5) HEX CAP SCREWS			BRIGHT HEX CAP SCREWS		
Diameter and Threads Per Inch	Minimum Tensile Strength (Based on 160,000 PSI)	Minimum Shear Strength (Single Shear)	*Usable Strength In Tension	Minimum Tensile Strength (Based on 120,000 PSI thru ¾" & 115,000 PSI for ⅞" & 1")	Minimum Shear Strength (Single Shear)	*Usable Strength In Tension	Minimum Tensile Strength (Based on 68,000 PSI)	Minimum Shear Strength (Single Shear)	*Usable Strength In Tension
¼-20	5,088 lbs.	2,544 lbs.	3,434 lbs.	3,816 lbs.	1,908 lbs.	2,442 lbs.	2,162 lbs.	1,081 lbs.	1,272 lbs.
⅜-16	12,400	6,200	8,370	9,300	4,650	5,952	5,270	2,635	3,100
½-13	22,704	11,352	15,325	17,028	8,514	10,898	9,649	4,824	5,676
¾-10	53,440	26,720	36,072	40,080	20,040	25,651	22,712	11,356	13,360
⅞-9	73,920	36,960	49,896	53,130	26,565	29,937	31,416	15,708	18,480
1-8	96,960	48,480	65,448	69,690	34,845	39,269	41,208	20,604	24,240

**Based on average pre-tensioning of the fastener to 80% of minimum yield strength*

Applications Pointers Based On Relative Strengths

By considering strength requirements, coupled with relative costs, the design engineer can often quickly determine the best fastener for a specific application.

Here are some obvious examples:

1. When you need the greatest possible fastener strength in a limited joint area, socket cap screws are your obvious choice.
2. In rigid joints, heat-treated hex cap screws provide the greatest possible clamping force *per dollar cost.*
3. In bolting low strength materials, where high clamping forces cannot be applied without indentation, bright hex cap screws are the most economical selection.

Additional information on the relative merits of heat-treated and bright hex cap screws is detailed in an earlier advertisement. (Copies forwarded promptly upon request.)

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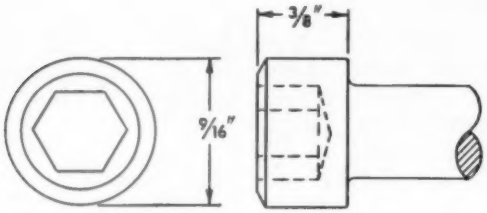
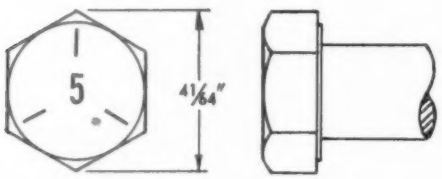
Difference In Head Size and Conformation

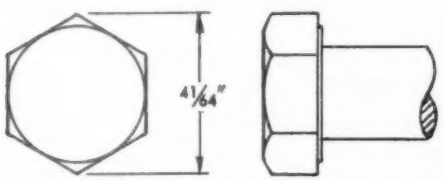
The drawings below show the relative dimensions and conformations of a typical socket and hex head cap screw (size used is 3/8" diameter.)



SOCKET HEAD CAP SCREW



HEAT-TREATED HEX CAP SCREW



BRIGHT HEX CAP SCREW

Application Pointers Based On Conformations

Again, the different head conformations dictate the use of a specific fastener for many applications. In crowded joints, smaller socket cap screws can often solve problems. They are obviously superior for flush mounting applications where counter-sinking is desired. In tight locations, they require far less wrench clearance.

Other wrenching factors also play an important part in determining whether socket or hex heads are best. If blind wrenching is indicated, socket heads are the outstanding choice. On the other hand, for consumer equipment, we can assume that conventional wrenches for hex head screws will be more commonly available than socket screw wrenches.

For industrial equipment, such as machine tools, this situation can be rectified by shipping the required socket wrenches (hex keys) directly with the product, attached to it in some simple fashion. Since hex keys are relatively inexpensive, compared with conventional wrenches, this enables the designer to provide customers with a more complete piece of equipment without appreciably raising the cost.

What About Appearance?

Although it is a somewhat intangible factor, a wise designer should consider the relative appearances of the two types of fasteners before arriving at his final selection. For example, in small-size precision equipment, socket head cap screws often contribute to a more finished, precision appearance. On the other hand, the use of only three or four fasteners to attach a large cover plate to a huge piece of equipment may present a somewhat incongruous appearance, even though they are adequate from the standpoint of tensile and other strengths. Here, a large number of less expensive fasteners may be more desirable.

Don't Create Inventory Problems

Overspecialization in selecting fasteners can defeat any economies realized, if it results in excessive inventories. Therefore, whenever possible, attempt to combine fasteners used for various applications. For example, good inventory practice usually indicates stocking only the strongest grade of any given fastener size and using it for all applications . . . except where extremely large quantities are involved.

For Further Information

Call your Stanscrew fastener specialist, for suggestions on your particular assembly problem. He is quickly available for consultation through your local Stanscrew distributor . . . who offers over 5,500 different standard fasteners . . . can supply an economical answer to almost every industrial fastening need.

STANSCREW FASTENERS

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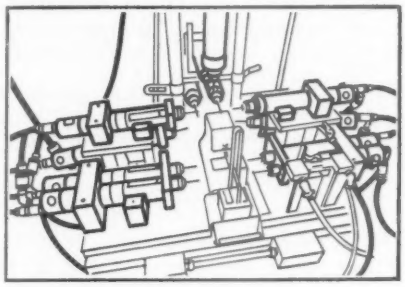
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

ARO IS YOUR ANSWER— LOW COST *Automation!*

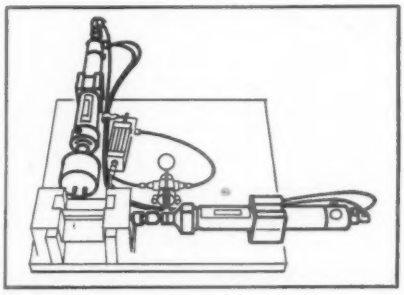
DRILL 3,000 per hour

Set up any number of Aro Self-Feed Drills in single fixture, then drill up to 3,000 holes per hour automatically. Capacities from $\frac{1}{16}$" to $\frac{1}{2}$" . . . speeds from 500 to 20,000 rpm . . . stroke lengths from $\frac{3}{8}$" to 6". Use any combination of types and speeds, mount drills in any position.



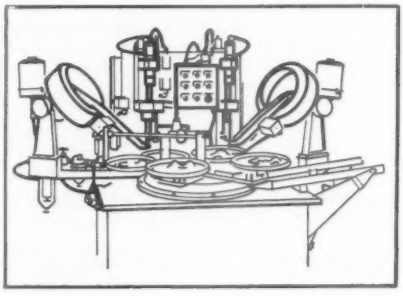
TAP 2,400 per hour

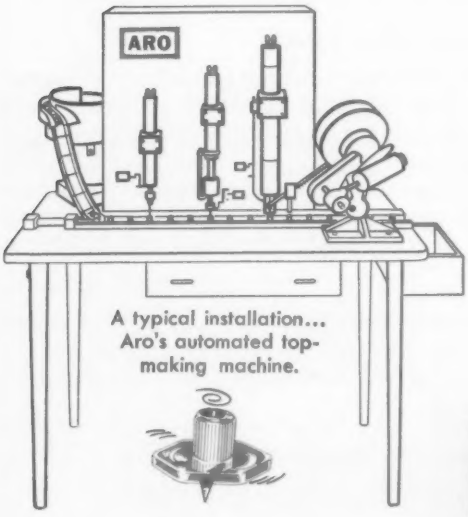
Combine your drilling and tapping operations in one fixture and eliminate costly handling. Aro Self-Feed Tappers have capacities up to ¼"-20 in mild steel, or larger holes in softer materials. Speeds of 500, 900, 1,450 and 2,700 rpm. Stroke lengths up to 1½". Accessories for precision depth.



FASTEN 3,000 per hour

Go automatic on your threaded-fastener operations with Aro Self-Feed Screwdrivers-Nutsetters. Standard range of speeds for the most commonly specified screw sizes. Uniform torque settings held within close limits. All models available with precision ball-type clutch.





A typical installation... Aro's automated top-making machine.

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SEPTEMBER, 1960, VOL. 3, NO. 9

THE WAILING WALL . . . AND THE TECHNOLOGICAL RACE

In last month's "wailing wall" editorial, we presented our views on why enrollment in engineering schools is declining while over-all college enrollment is rising. Along the way we touched upon some pertinent issues, including the technological race with the Russians, and concluded with, "Either we keep in the race by encouraging our youth to the sciences and engineering, or we collapse of our own doing."

Already, a number of you have commented favorably on these views. However, we got some disagreement from a well-meaning reader who took the time to write a two-page objection to our entire editorial. He especially took exception to our statement that engineering enrollment was declining. Of course, disagreement here alone would nullify the other points.

Perhaps our thinking was too obtuse, and should be clarified with additional facts for the benefit of those not fully awake to the seriousness of the situation.

So herewith are some official statistics from the Federal Education Commissioner concerning the growing lack of interest by our young people in the sciences and engineering.

In the fall of 1958, when over-all college enrollment was up 190,139 over 1957, there were 11,982 fewer undergraduate engineers, including 8,728 fewer freshmen engineers.

In the fall of 1959, with over-all college enrollment up an additional 143,741, there were 13,787 fewer undergraduate engineers than the year before, including 2,289 fewer freshmen engineers.

The net results show that while college enrollment went up 333,880 in a two-year period, undergraduate engineering enrollment went down 25,769, including 11,017 fewer freshmen engineers.

These figures show an alarming trend, which if not reversed will greatly hinder our efforts to keep ahead in this technological race. And if American free enterprise doesn't do something to attract our young people to the sciences and engineering, then we may well lose the race by default.

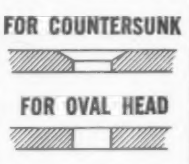
Managing Editor

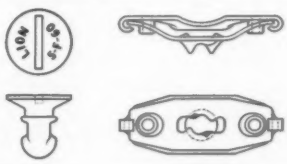
Captive Quick-Opening Fasteners:

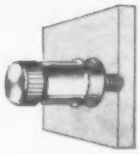
Southco standards provide many benefits at low cost for access through doors, covers, panels and into drawers

LION ¼ TURN FASTENERS

Quick, positive locking, by fractional turn. Tight seal formed by compression of leaf spring. Alignment and stack height not critical. Approved for aircraft use. Rugged. Extra strength provided by swaged nose. Vibration resistant.

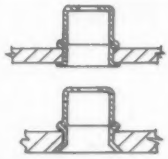


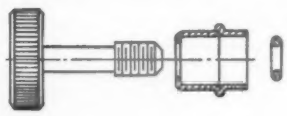


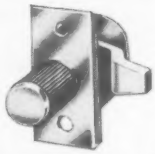


RETRACTABLE SCREW FASTENERS

Stand-off thumb screws from stock to eliminate costly, special fasteners. Installed quickly without special tools. Accommodate misalignment. Complete range of standard sizes.

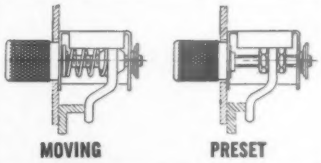


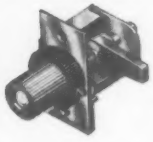




ADJUSTABLE PAWL FASTENERS

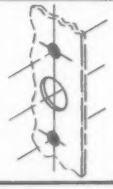
Pre-assembled, quickly installed. Accommodate variations in frame thickness up to ½ inch. One-quarter turn closes, additional turns increase grip pressure. Attractive appearance, long life. Moving or pre-set pawl. Miniature, intermediate and large sizes.

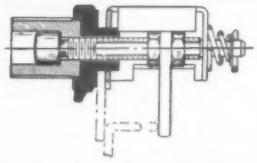




ADJUSTABLE PAWL FASTENER

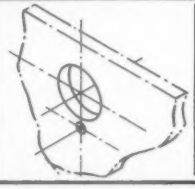
Has twin-knob control. One knob controls pawl, pointer shows pawl position. Other knob controls amount of pressure to seal closure with uniform pre-set compression. Easily installed.

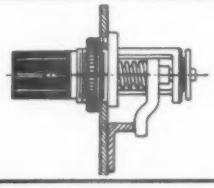




ADJUSTABLE PAWL FASTENER

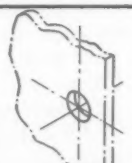
Compact and rugged. Eliminates rivets or bolts to save installation time. Three types cover grip range up to ¾". Supplied either with integral metal and plastic knob, plastic knob or for your knob.

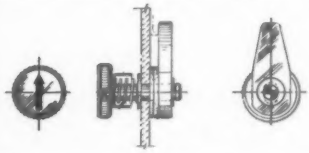




ARROWHEAD DOOR LATCH

Requires only one hole to install. Operates on quarter turn. Holds under spring tension. Arrow shows pawl position; no pawl stops required. Uses minimum inside space.





Free Fastener Handbook

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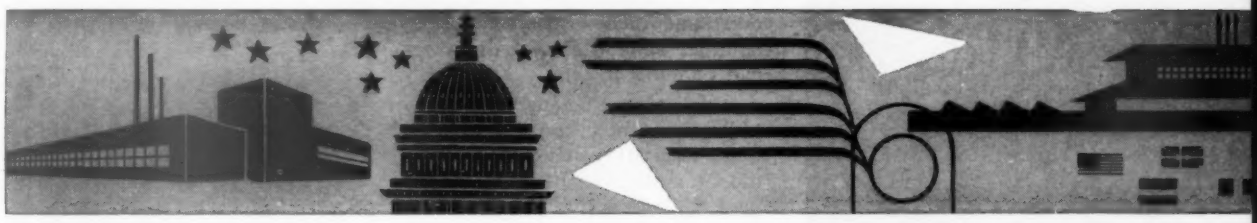
The State of Business



TAXES AND ECONOMIC GROWTH

by **Dr. Robert W. French**

"Economic growth" is one of those rare things which all Americans are "for." We all want to see our economy grow to produce more goods and services and to provide more jobs, higher incomes—even more revenue for government along with a lighter tax burden.

A genuine growth in our economy can yield all of these things. By 1970 the United States will have a population of about 220 million and a potential working force of more than 80 million. Assuming continued advances in technology, this increase in population will give us the manpower to raise our production of goods and services by 50% in the next 10 years up to an annual gross national product of $750 billion at current prices. Even with a larger population, this level of production can mean that the annual income for the average family—today about $6,500—will increase to around $8,000!

To some, the creation of 13 million new jobs in the next 10 years can only be achieved by a greater infusion of Federal funds and control. The sphere of government must be enlarged, they say, to guarantee that our economy will provide these jobs. They argue that government, now spending at the rate of $132 billion a year, or 28% of our gross national product, must spend more, much more. This expenditure will raise the total number of dollars for goods and services and show, at least on paper, that our economy is growing.

U.S. Budget Director, Maurice Stans, who has repeatedly warned that the fiscal irresponsibility of recent decades cannot be extended into the 1960's without grave consequences, has branded this appealing theory of more spending as simply a poorly-disguised version of an old proposition: "that we can spend ourselves into prosperity."

As the budget director is well aware, to spend more money the government must either borrow the money—adding to its present $286 billion debt and increasing the threat of inflation—or it must collect more money through higher taxes.

Most American are now turning over about $1 out of every $4 they earn to government. This, according to Tax Foundation, Inc., is the effective rate imposed by the total burden of all Federal, state and local taxes on four out of five families, those with incomes between $2,000 and $15,000. Lower incomes are taxed at slightly higher rates because taxes, like social insurance, take a higher percentage of total income. On higher incomes tax rates now rise up to the point where government is taking more than $3 out of every $4 of income.

ROBERT W. FRENCH

President
Tax Foundation, Inc.

Respected economist and educator, Dr. French left his post as Director of the Port of New Orleans in 1959 to lead Tax Foundation, Inc.

Americans are now paying about nine times the taxes collected in 1940 before World War II. But all the blame can't be put on the war; tax collections have nearly doubled since 1950. And, contrary to general belief, the bulk of the recent increase in Federal spending has not been for our nation's defense. While defense spending has risen about 12% in the 1955-60 period, spending for domestic programs has risen 37%.

As a result, the average American now has to work longer to pay his taxes than to pay his food and clothing bills. It was the other way around 10 years ago. He now works about 2 hours and 16 minutes a day, or almost 1½ days out of his 40-hour, five-day work week, to pay taxes.

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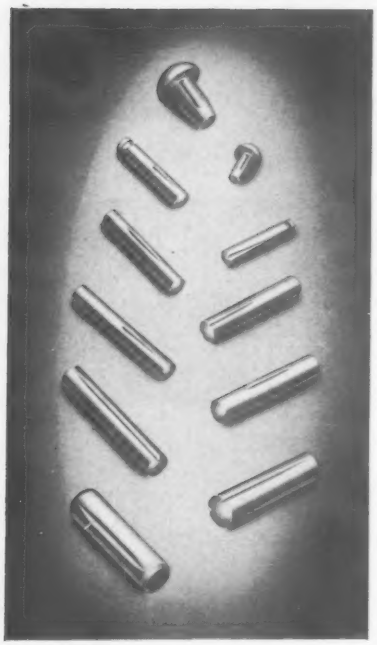

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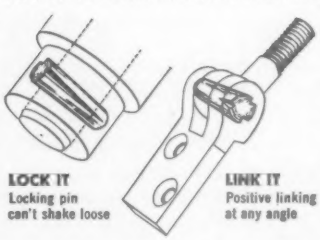
Groov-Pins are made to meet your requirements, too. Standard sizes run from 1/32 to 1/2", specials to fit your needs at standard prices over 5,000 pieces. Send for illustrated catalog, free samples.



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The Tax Foundation has estimated that there are at least 151 taxes on a loaf of bread, 116 on a man's suit, 100 on an egg, 150 on a woman's hat, and 600 on a house. It also estimates that these "hidden" and direct taxes may take as much as one-third of the average person's income.

Although politicians like to talk of "making the corporations pay", it is not difficult to see that most taxes on business are simply passed along to the consumers in the form of higher prices and the tax becomes hidden in the price.

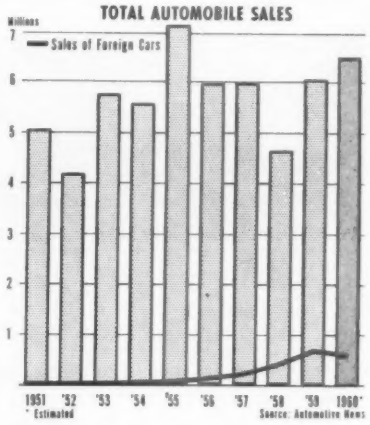
With taxes at these levels, just about everything that is sold in the U.S. has to have a higher price tag. This fact helps to explain how the tax load imposed by government is making it increasingly difficult to sell higher-priced American goods overseas and also why an ever-increasing number of American industries are finding it to their advantage to manufacture their products in foreign countries.

The complaint is sometimes raised that our economic system is running out of steam, that it is only growing at an annual rate of about 3% when Russia is claiming an annual rate of about 8%.

The truth is that our economic system is showing tremendous vitality despite ever-mounting government spending, taxes and debt. Total expenditures of Federal, state and local governments have risen from $61 billion in 1950 to an estimated $132 billion in 1959. The three levels of government which claimed about one-fifth of total goods and services produced in 1942, were, through taxes, taking slightly more than one-fourth of net national product, in 1950 and last year took 28.3%.

Instead of showing impatience with an economic system that has given this nation the highest living standard in history, we should take steps to keep taxes under control. Removal, reduction and reform of the intricate—and many outmoded—taxes and tax regulations that discourage growth, would go far to enable this country to reach its productive potential during the 1960's. •

Tax Foundation, Inc., is a private, non-profit organization engaged in research and citizen information on Federal, state and local government spending and taxation. Its purpose is better government at lower cost.



Sales of automobiles this year will be second best on record with imported cars accounting for a smaller proportion than last year.

Industry Briefs

Grass roots resistance grows to any tariff cuts at this month's international meeting. The U.S. problem is illustrated in industrial fasteners where exports have decreased 50% since 1952, imports up 600% . . . Appliance stocks of over 3.7 million have caused G.E. and Frigidaire to lead a general price cut . . . General Dynamics became the Pentagon's biggest supplier in 1959 with $1.5 billion in orders, moving ahead of Boeing . . . Antitrust legal activity is still rising . . . Ford's 1961 Falcon introduction (scheduled for Flora, Ill., where 1300 car owners will be loaned a new model for a week) has been delayed a week until Sept. 19 by the July supplier strike . . . In a boycott attempt, UAW Local 155 wired Khrushchev, asking that Russia reject a Cross Company bid on an automation machinery order. Bargaining dispute . . . To shore-up the sagging coal industry, Congress will give the Interior Dept. $2 million to research new uses for coal . . . Studebaker-Packard broke a long-time taboo by offering stockholders a $100 discount on its line during summer months . . . Inland Steel operated at 60% of capacity in July compared to 88% and 93% in the first two quarters. •

IDEAL

SPECIFIES KEYSTONE WIRE FOR WIRE CONNECTORS

"We use Keystone MB Spring Wire because we know our spring coils will meet rigid specifications. That is the secret of the success of our solderless wire connectors," says Paul Cherry, Plant Superintendent of Ideal Industries, Inc., at the Petersburg, Illinois, plant.

Ideal Industries were the original designers and manufacturers of wire connectors for electric wiring in appliances and home construction. Their "Wire-Nut"* connector with a copper-coated conical spring, securely contained in a plastic cone, is the standard for electrical contractors the world over.

Ideal, a major supplier to world markets, emphasizes quality control by continuous inspection of their tiny wire spring coils.

Keystone's metallurgical and research engineers worked closely with Ideal Industries, Inc., to develop a special MB Spring Wire for its product. Close diameter tolerance, uniform temper throughout the coil, special surface for copper and cadmium plating and lubricant qualities for high-speed production were the results of this research effort.

Delivery is made in moisture-proof fiber drums for protection of plating quality finish during shipment or storage.

Take a cue from Ideal Industries and let Keystone solve your wire problems. Call your Keystone Wire Representative soon or write us for details; we will be pleased to help you.

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WIRE FOR INDUSTRY

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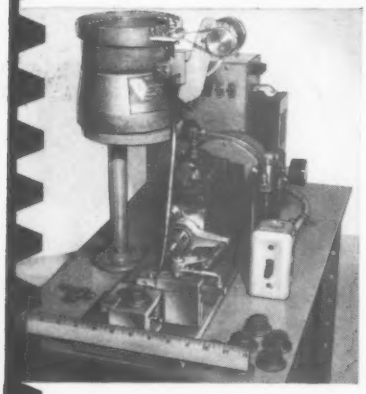
*Reg. TM Ideal Industries, Inc.

new hopper feeder

QUADRUPLES SET SCREW INSERTION RATES



Labor costs cut by 75%

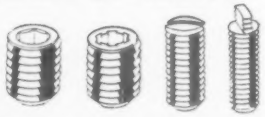
Changeover from manual to automatic insertion of set screws is now easier and more profitable than ever. More profitable because this new, compact, Setko Hopper Feeder requires less space — and embodies advancements and refinements in design to make for greater operating efficiences. It is now possible to actually quadruple insertion rates over the hand method, while cutting labor costs by 75%.

Operation of the machine is less complicated than the hand method. All the operator has to do is feed the workpiece to the receiving pad and the machine automatically drives the screw to a predetermined depth. Every screw is uniformly inserted.

Additional savings result from a reduction in rejects and floor loss. Users report "rejects have been cut to almost zero and floor loss has been eliminated!"

More than fifteen years of experience in the design, engineering and manufacture of Hopper Feeders is behind the cost-cutting, production-increasing performance of this new model.

WILL FEED ANY TYPE OF HEADLESS SET SCREW AND WITH ANY POINT



Hex Socket, Fluted Socket, Slotted or Slabbed heads and with any type point, can all be oriented and fed with equal efficiency.

SEND TODAY FOR FULL INFORMATION

Send your specifications for full recommendations and quotations. Ask for Catalog 23 showing the full line of Setko Socket Screw Products.

SETKO Set Screw & Mfg. Co.

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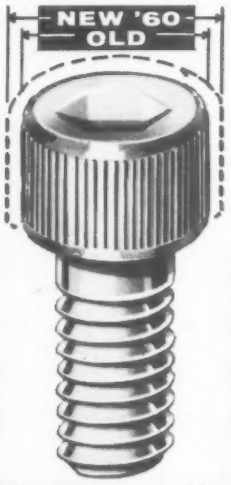
MORE HOLDING POWER

with **SETKO'S '60* SERIES** socket cap screws



- **Bigger heads** take greater tightening torques without indenting.
- **Broader bearing area** under head distributes load over larger area.
- **Better strength** characteristics assure longer life—can be re-applied more times.
- **Stainless Steel Cold Forged Cap Screws** now available in many sizes.

Now you can get Setko's "perfect-hole" precision in the new '60 Series. All of the outstanding qualities of precision-made Cold Forged Cap Screws are combined in this new, larger-head size series, to give you increased holding power, and longer, more dependable performance.

In some cases you actually need fewer Cap Screws because of the increased holding power. The broader bearing area under the head stops needless indenting of material — and often eliminates the need for washers. With the Setko '60 Series Socket Cap Screws you can cut costs, increase reliability and step up performance.

WRITE FOR FULL INFORMATION on Setko's '60 Series. Cold Forged, Socket Cap Screws. Tell us your requirements for recommendation and quotations.

*Old series will continue to be available

SETKO Set Screw & Mfg. Co.

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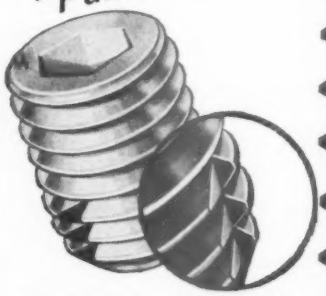
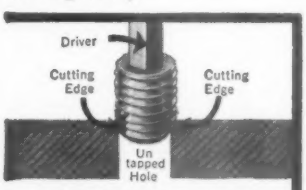
NEW SELF-TAPPING* SET SCREW

actually "Pulls Itself In"



- **Eliminates tapping problem!**
- **Increases product reliability!**
- **Cuts production cost!**

You can completely eliminate the tapping problem while increasing product reliability with Setko *Self-Tapping Set Screws!* Exclusive, tool-sharp, cutting edges, located on the lower threads of the screw, actually cause the screw to "pull itself in" — Shavings are gathered into the oversize slots ... Holds securely even under extremes of vibration. You'll find they serve equally well to clean out painted holes or as reaming screws. Can be reapplied many times without loss of cutting or holding ability.



Note how three-grooved cutting edges give full cutting tooth for easy "pulls itself in" application. Gives tight, snug fit, in plastic or metal.

SEND FOR FREE TEST SAMPLES TODAY...

Tell us your requirements and we'll forward full information and recommendations, along with your samples, free of charge.

*Patent pending

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We specialize in solving puzzling screw problems

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Industry at Work

NEW WIND TUNNEL HEATS TO 14,000°F, BLOWS UP A MACH 27 STORM

(Top) Aerodynamicist Shirley Holmgreen checks the placement of a research model in the 44" wind tunnel's test section. (Bottom) Electrical Engineer Roy Kessler uses a "wand" to assure the complete discharge of one of the 2280 capacitors before inspecting fuses.

Boeing Airplane Company, Seattle, has begun regular operation of its new $1 million electrical arc discharge wind tunnel—the largest privately owned facility of its kind in the world.

The "hotshot" is designed to operate in the speed ranges from mach 10 to mach 27, at temperatures up to 14,000°F and to simulate altitude conditions up to 260,000 feet or approximately 50 miles. Its addition provides the company with aerodynamic research capabilities in all speed regimes from low subsonic to the orbital speed of space vehicles, or from about 20 miles an hour up to 18,000 miles an hour.

The tunnel itself consists of a 56-foot conical steel tube with the test section or point in which the test article is mounted measuring 44" in diameter.

Key to the tunnel's operation is in a cooled and air-filtered adjoining room. Here electrical energy capable of delivering an impulse equivalent to 5-million horsepower is built up and stored in 2280 capacitors. Coaxial cables link each capacitor to a collector wheel which brings the individual charges into a single conductor leading from the room into an arc chamber at the "upstream" end of the tunnel.

The arc chamber, variable in size through the use of insert plugs, is machined out of a stainless steel casting. To ready the tunnel for a run the chamber is charged with air to pressures up to 2000 psi while the pressure in the test section is pumped down virtually to vacuum level.

Separating the test section and the arc chamber is a tungsten nozzle. The mach number of the test is controlled by varying the size of the nozzle opening which ranges from one-twentieth to one-half inch. The smaller the opening the higher the mach number.

The pressure differential between the arc chamber and the tunnel is maintained by a thin plastic diaphragm between the nozzle and the arc chamber.

continued

General Vibrex
MULTI-FUNCTION
FASTENERS

The versatile half-turn fasteners combine the advantages of a quick acting panel lock with those of an elastic shock isolator.

- *Damp noise*
- *Eliminate rattles*
- *Simplify assembly*
- *Correct Alignment*
- *Absorb shock, vibration*

The Vibrex Fastener locks by means of an expanding, waterproof and dustproof sleeve of especially compounded rubber. This forms an elastic suspension which actually floats the panel-base assembly in live resilient rubber.

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For dependable service

and immediate delivery*

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AVNET•1262 N. Lawrence Sta. Rd., Sunnyvale, Cal.- RE 6-0300

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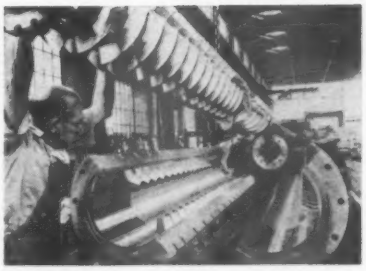
Discharge of the stored electrical energy in the capacitor bank in approximately two one-thousandths of a second heats and further pressurizes the air to as much as 30,000 psi. These extremes of heat and pressure vaporize the diaphragm and the heated air forces its way through the nozzle, accelerating at hypervelocities into the test section.

Usable test time is approximately one-tenth of a second before the air bounces off the far end of the tunnel disrupting the flow at the test section. The downstream end of the tunnel is covered by a four-layer mesh of common chain. This protects the tunnel walls in event a test model should break up, but permits the air to proceed in an uninterrupted flow. Test data is recorded on high speed oscillographs with a total of 50 recording channels.

Scheduled to figure heavily in the development of Boeing's Dyna-Soar manned space glider and Minuteman intercontinental ballistic missile programs, the tunnel is expected to average two to four runs per day.

General Electric built the capacitor bank and Electric Steel and Foundry Co., Portland, the arc chamber.



OPENED UP to accomodate a 16-ft. stainless steel mixing screw is a 21-ton continuous mixing machine for the food industry. The Baker Perkins' machine's chamber and flight teeth are machined to .0005". To produce the screw, it was necessary to build up by welding a solid 10" diameter bar.

NEW POTTING TECHNIQUES FOR COMPUTER SUB-ASSEMBLIES

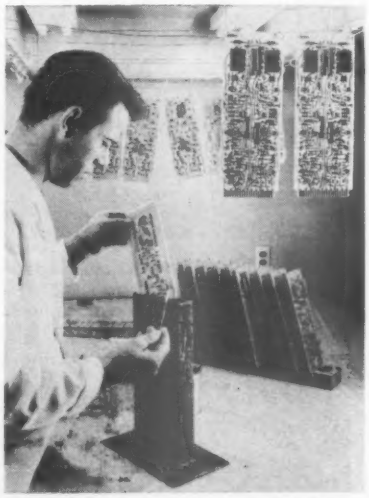
New potting and protective coating techniques for complete computer sub-assemblies have been developed for protection against humidity, contamination, shock and vibration. Librascope gives this protective treatment to the printed circuit boards which comprise the "intelligence" of the digital computers.

The coating process consists of dipping or spraying the assembly with epoxy. After leaving the coating section, the circuit boards are baked at a maximum temperature of 150°F to harden the thermosetting epoxy. Masking tape, which is used to keep contacts and terminals free from the plastic coating, is removed after the boards leave the ovens.

The potting operation protects "stacks" of two or more circuit boards. These are assemblies with boards joined in parallel forming an open-sided box-like construction, with electronic components on both the inside and outside of the box. The parts on the inside are protected by filling the space with plastic.

Epoxy is also used in the potting, with special fillers added to provide maximum heat dissipation. The boards are placed in jigs and the liquid plastic resin poured in. The assemblies are then oven cured in the same manner as the coated boards, and the jigs removed. After both coated and potted boards are removed from the curing ovens, they are given a complete visual and dielectric inspection, according to George Magurean, in charge of the process.

continued



To increase the reliability of digital computers, logic cards are now potted in pairs and dipped in an epoxy resin.

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ALREADY PLANNING MANNED FLIGHTS TO VENUS, MARS

American spacemen, in atomic powered interplanetary ships, may be pushing to Mars and Venus by 1970-71, predicted Krafft Ehricke, program director for Convair Astronautics. Space craft carrying eight men could make short "look-see" flights of about one to one and one half years to survey the surface and atmosphere of Mars and Venus. The space craft would orbit each planet while its crew members record observations.

The first craft up there probably won't attempt landings, said Ehricke, except possibly for political reasons. A landing would require extra personnel, at least double the "payload" capacity of the spacecraft, very long periods (two to three years) away from earth and would greatly reduce the surveillance possibilities offered by orbit operations.

He set the target dates that would enable the U.S. to send manned missions to interplanetary space: nuclear heat exchanger engines will be developed by 1965 and manned lunar ships will use them from 1965 to '70. Long-term orbital flight testing of crews, their life support system and other vital components will have been conducted in satellite test facilities during 1960 to 1963 and nuclear energy will have become available in electric systems for many purposes. During this decade, instrumented space probes will have given an idea of existing conditions in far space.

The space vehicle would range in height from about 460 to 480 feet. At one end of a 100 foot stem are the "life support systems", where the crew lives. At the other, at a safe distance away will be the nuclear power plant and fuel pods.

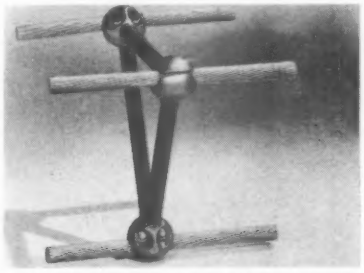
The power system to boost a spaceship out of the earth's pull and into a fast reconnaissance mission would have to provide a velocity of 60,000 to 90,000 feet per second, said Ehricke, because the ship has to get through the Van Allen belt of radiation as

quickly as possible. Since the booster engine would be too powerful for any other maneuvers, it will be jettisoned, along with the booster tanks. For orbiting the target planet and returning to earth, tanks containing hydrogen are arranged around a central stem from which they can easily be separated after they are emptied.

INTRODUCE CONDUCTOR SPACER ON POWER PROJECT

A non-edible "hamburger bun" promises to play a key role in satisfying America's growing appetite for electrical energy.

"Hamburger bun" is the name given by Aluminum Company of America engineers at the Rome Cable Division to a spacer for bundled transmission conductors.



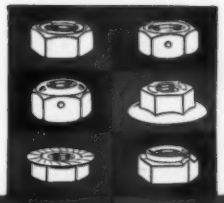
Designed to hold in proper physical relationship the two or more conductors in an electrical transmission line "bundle," spacers consist of aluminum clamps at the ends of helical stainless steel springs.

Its nickname arises from the appearance of the two oval clamps at either end of the spacer's helical spring body.

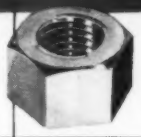
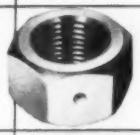
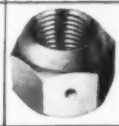
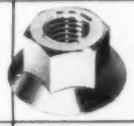
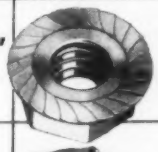
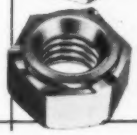
The new spacer is presently installed by the New York State Power Authority on a 140-mile, double circuit line, to be operated at 345 kv. It is part of a tie-line to connect the new Niagara and St. Lawrence Power Projects.

Design of the spacer provides column strength to resist short circuit forces, and great flexibility in other directions to permit normal conductor movement. It incorporates a stainless steel spring, separating cast aluminum clamps.

A variant design, responding to current utility industry interest in three-conductor bundles, has been produced by Alcoa. It is a "tri-spacer," using the same type of helical spring component, with spherical clamps. •

One  of these
CAN IMPROVE YOUR PRODUCT . . .

SIX GREAT
MACLEAN-FOGG
LOCK NUTS

MF **UNI-TORQUE**		A free starter with lock at the top. Withstands severe vibrations. Cuts assembly time.
MF **TWO-WAY**		The Lock's in the center of nut. Can be applied from either end. Permits bolt end to be flush with, or below, top of nut.
MF OPEN END **CAP NUT**		Has two-way center-of-nut lock. Used on furniture, appliances, toys, lawn mowers, tools, etc.
MF UNI-TORQUE **FLANGE NUT**		Combination lock nut and washer. Use on oversized holes; where extra bearing surface is needed.
MF **"WHIZ-LOCK"** FLANGE NUT		This one spins on. Serrations take a firm grip on work. Break loose torque higher than seated torque.
MF PILOT TYPE **WELD NUT**		You can have it with or without lock. Simplifies assemblies by means of self-locating pilot.

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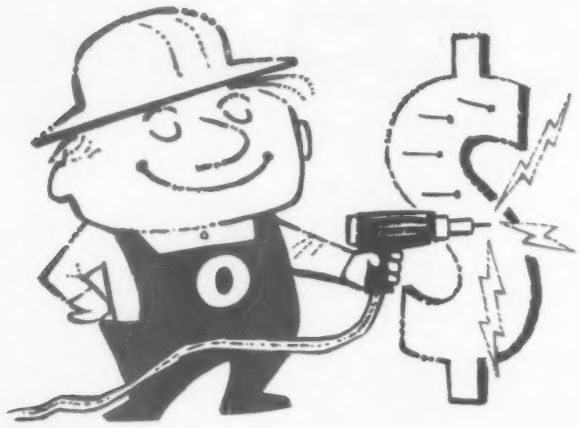

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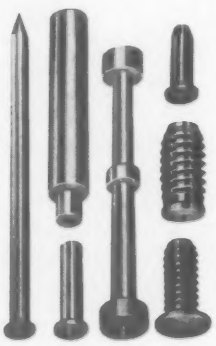

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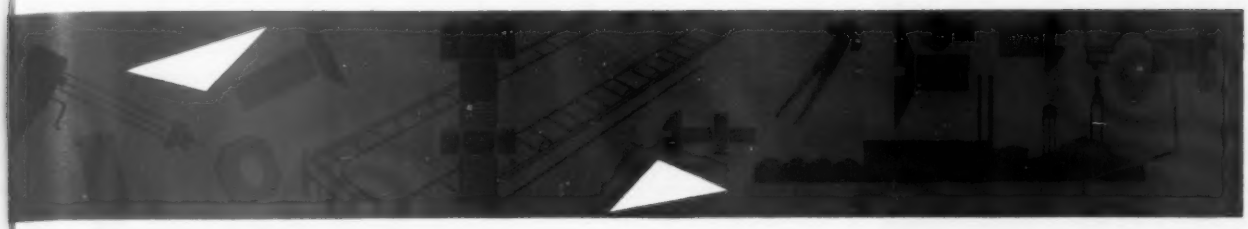
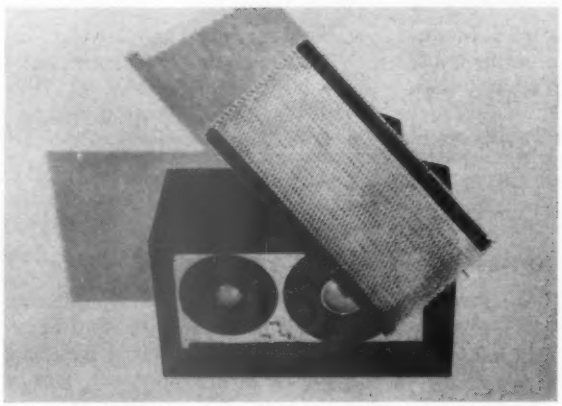
Assembly and Fastening Ideas





Velcro tape fastener assures a continuous closure on hi-fi speaker grille and speeds assembly.

TINY HOOKS, LOOPS FASTEN HI-FI GRILLE

Easy access for servicing its hi-fi speaker is one benefit Acoustic Research, Inc., Cambridge, Mass. reports from using a nylon tape fastener on the grille of its unit. Velcro also speeds installation and reduces vibration noises.

In this application, the hook portion of the tape is glued to the wooden speaker enclosure. The pile section is glued to the aluminum grille frame. Press together to fasten. Pull apart to close.

The fastener works on the principle of using the cumulative locking strength of hundreds of tiny hooks and loops to create a bond with tested shear of 6-8 lbs. psi. Velcro lasts through more than 50,000 open-close cycles, equivalent to over 100 years of daily use. Its three areas of general use are as an adjustable fastener, a detachable fastener and for closure.

BATTELLE GAS-BONDS DISSIMILAR METALS

Joining dissimilar refractory metals, long a problem for metallurgists, is being made easier by a new gas-bonding method developed at Battelle Memorial Institute, Columbus, Ohio.

The important steps in the method are illustrated in the bonding of a typical reactor fuel subassembly. The prepared parts—uranium alloy fuel elements, zircaloy strips for cladding, and steel separators, with zircaloy pins inserted—are assembled in a metal container. After evacuation and welding, the container is placed in an autoclave (photo right) where bonding is accomplished by the uniform pressure of helium gas (10,000 psi, with temperatures to 2500°F, depending upon materials) upon parts in the evacuated container. After the bonding is completed, the steel separators are etched out, leaving open passages between the clad fuel elements, but with the zircaloy pins remaining to strengthen the assembly.

continued

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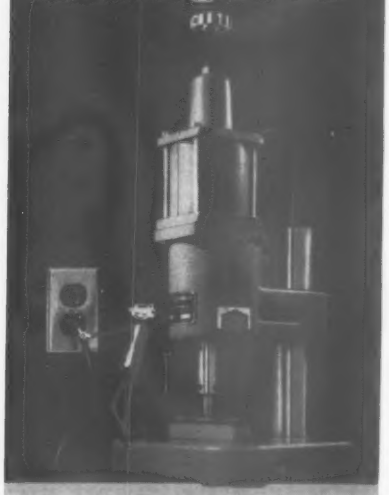

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According to Stanley J. Paprocki, chief of the fuel-element division, and Edwin S. Hodge, assistant chief, the method has these advantages: 1) it produces complex shapes easily; 2) it clads brittle materials; 3) it gives close dimensional control; 4) it clads and densifies cermet materials in a single operation; and 5) it trims fabricating costs as much as half.

Recent studies have shown that gas bonding is valuable in other applications—including preparation of composite metal tubes and corrosion-resistant containers, the compaction of powder-metallurgy parts and assembly of sandwich structures of dissimilar metals.

(Top) A typical gas-bond is seen in this photomicrograph. (Bottom) Parts prepared for bonding are assembled in a metal container.

INTERCONNECTING SNAP-LOCK PANELS SIMPLIFY ASSEMBLY

A Green Bay, Wis. truck manufacturer has built an entire truck body out of panels which snap-lock into each other.

"We are using a new concept of aluminum extrusions that cuts assembly time 20%," said Donald Fleming, president, Olson Trailer & Body Builder Company.

The Reynolds Metals extrusions may be used in a series to make almost any kind of continuous flat or curved surface. The interconnecting feature is designed into the panel.

HIGH STRENGTH ADHESIVE PROLONGS TOY PISTOL "TUNE"

The high strength and vibration resistance of a quick-setting adhesive have added life to a critical part of a toy pistol.

The Ric-O-Shay Pistol, produced by The Hubley Mfg Co. of Lancaster, Pa., has a device mounted in the pistol butt which simulates the sound of a whining bullet each time the trigger is released.

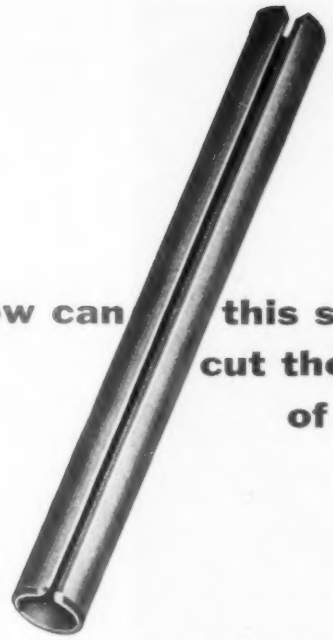
The sound is generated by a bent musical wire vibrating against a thin brass percussion plate. The effect, pitch, and duration of the sound are dependent upon the positioning and rigidity of the fixed end of the wire.

To gain the necessary rigidity a zinc alloy slug is die-cast onto the fixed end of the wire. This fits snugly into a hole in a die-cast ring which surrounds the percussion plate. Sufficient clearance is provided at the bottom of

continued

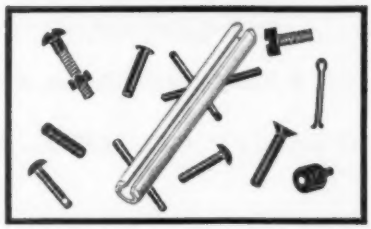
The first step in making the bond is to dip the metal insert into the adhesive (left). The worker then manually fits the insert into the lug hole in the ring and percussion plate. Then the two parts are hammered together in an electric press (right).

How can this simple fastener cut the cost of your product?



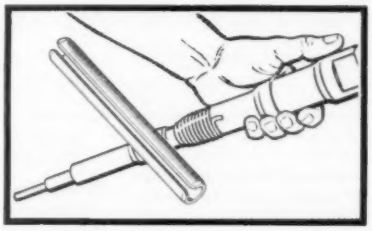
Rollpin aids standardization and reduces inventory

Rollpin readily replaces taper pins, grooved pins, straight pins and set screws; it can be used as a locating dowel, hinge pin, cotter pin, stop pin or, in some applications, even as a rivet. Thus, when you standardize on a Rollpin you can drastically reduce the variety of fasteners in your inventory—save money in purchasing, storage space and stock handling.



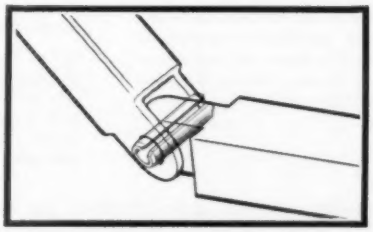
Rollpin simplifies production processing . . . saves man-hours

When you use Rollpin you can eliminate costly precision drilling, or tapping operations. And there's no need for any secondary locking operation—such as lock wiring or peening. That's because Rollpin is a slotted tubular steel spring whose chamfered ends drive easily into standard production-drilled holes, compressing as driven. The spring tension against the hole walls retains Rollpins securely against severe vibration. Independent studies have shown that installed costs of Rollpin are as much as *91% less* than those for a dowel pin or *95% less* than the installed cost of a taper pin.



Rollpin simplifies product maintenance

Only a drift pin or standard punch is required to remove a Rollpin. The slotted tubular shape and the spring action principle do not damage hole walls or enlarge the original hole diameter. Consequently the same pin is easily re-inserted and can be used again and again. Mail our coupon today for the complete Rollpin story.



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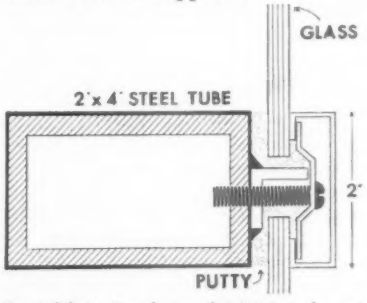
the hole to allow for "tuning" by tapping the slug.

Any movement of the slug after tuning would change the sound. Since the vibration of the wire would soon loosen the press fit, the two parts must be permanently secured after tuning.

A number of methods were investigated. The most successful was the use of Eastman 910 adhesive. The slug is dipped into a trough containing the adhesive just prior to being mechanically pressed into the hole in the die cast ring. The unit then passes to the final position on the assembly line where it is tuned. Hubley obtains 4000 bonds per ounce.

FASTENING DEVICE AIDS CONSTRUCTION CONCEPT

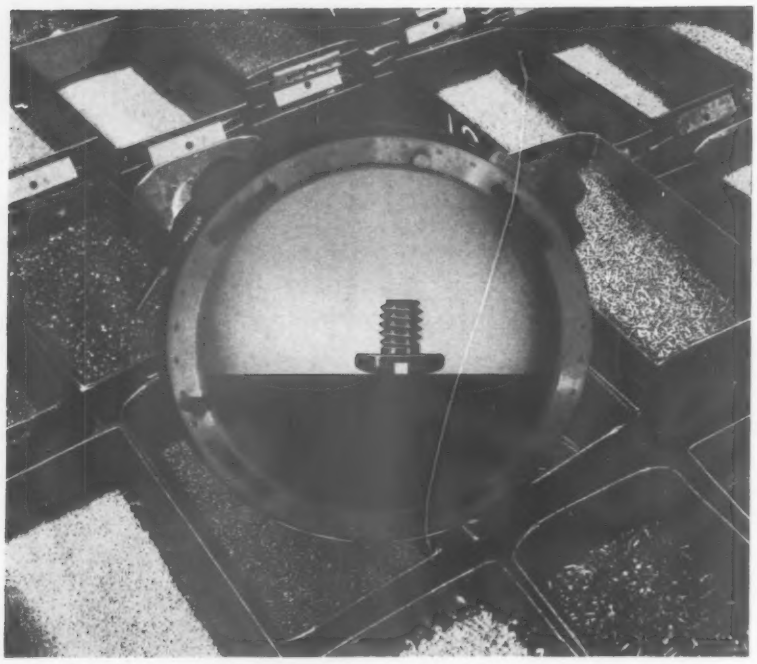
A fastening technique is the heart of a construction concept which uses square and rectangular steel tubes for columns. Metal curtain wall panels, glass masonry and other essentials are clamped and bolted directly to these vertical supports.



Special fastening devices for joining glass or metal panels to square or rectangular Republic Steel tubes are being widely used in one and two-story structures.

A cue is being taken from curtain wall skyscraper construction, where miles of tubes are used to hold side panels in place. Also, with wind loads transferred from exterior sheathing to building frames, many architects are specifying the tubing for a wide range of duties on low-level structures.

According to Port Chester (N.Y.) Iron Works, Inc., supplier for several school projects, flanges were attached to the side of the tubes to simplify the connection between masonry and steel. Special attachments are also made for glass and metal window and door units.



HUBBELL FASTENERS PASS INSPECTION AT 7 QUALITY CONTROL STATIONS

When a shipment of Hubbell fasteners leaves our Hubbell plant, everything humanly possible has been done to make those fasteners perfect in every respect. Here are the seven quality control stations that make every Hubbell fastener a finished precision product.

1. Raw materials inspected, dimensions checked, alloys tested.
2. Cold heading of blanks tested for material, quality and size accuracy. Blanks are tumbled to remove burrs and chemically cleaned.
3. After slotting, blanks are inspected for quality of cut and depth and width of slot; also for dimensional accuracy. Fasteners are again tumbled to remove slotting burrs and chemically cleaned.
4. Thread rolling operation precision checked for accuracy and fasteners chemically cleaned.
5. Secondary operations checked for dimensional accuracy and workmanship. Again chemically cleaned.
6. Plating operations checked to insure compliance with required specifications.
7. Orders inspected for quality and cleanliness prior to shipment to be sure no foreign matter is included that might jam automatic feeds. Sturdy, weatherproof containers sealed for shipment.

This quality can be your greatest production economy. For standards or specials, call Bridgeport, EDison 3-1181.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

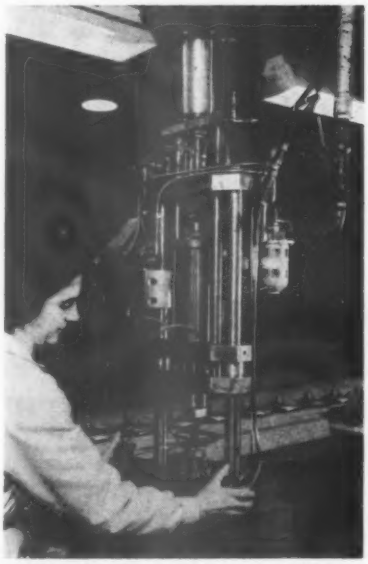
Quality FASTENERS

HARVEY HUBBELL, INCORPORATED
Machine Screw Department, Bridgeport 2, Connecticut

See the Hubbell Fastener Catalog in Sweet's Product Design File 7/Hu.

Use postpaid card. Circle No. 224

MODIFY STANDARD UNITS FOR MULTI-RIVETING SETUP



British designed multi-riveter is a modified air-operated, double-acting press.

Several semi-tubular rivets are set simultaneously on a special riveter developed by Rhoden Partners, Ltd., London designers of assembly machines. It is basically a modified pneumatic double-acting press.

According to development engineer G. Wittenberg, feeding and punching a pattern of rivets in one operation not only speeds assembly but also improves quality. Components are not distorted as is possible when rivets are set separately. In addition, the squeezing action of air-operated punches is less violent than the impact of a mechanical riveting machine, he claims.

The seven-sequence operating cycle begins by loading the components onto spring-loaded location pins in the bottom bolster. Depressing a button initiates a three second automatic process: work holder ram descends and clamps component, rivets are inserted into holes, punches descend and form over rivets, the work holder rams and punch rams rise together. The operator then removes the completed assembly.

Push-button actuating controls, remote from the tool area, ensure that the operator's hands will be in safe position when the rams descend. A compressed air supply of 80 psi is required for the unit •

HUBBELL COLD HEADING

MAKES THEM FASTER AND BETTER

Small fasteners like these Hubbell cold headed parts represent an area of saving often overlooked by management, who give careful attention to the cost and design of major components and little or none to the parts that hold them together. Yet here is the area where savings can be effected most easily and quickly.

Why pay for special tolerances and secondary operations when Hubbell engineers can design and mass produce a cold headed part that is stronger, cheaper and more uniform. For example, all of the above, and thousands more like them, have been specially designed for Hubbell cold heading. And each one helped to make the end product faster and better.

Investigate for yourself. Simply send us a blueprint of the part or a sample for analysis. Our engineers will gladly estimate.

This quality can be your greatest production economy For standards or specials, call Bridgeport, EDison 3-1181.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

Quality FASTENERS

HARVEY HUBBELL, INCORPORATED

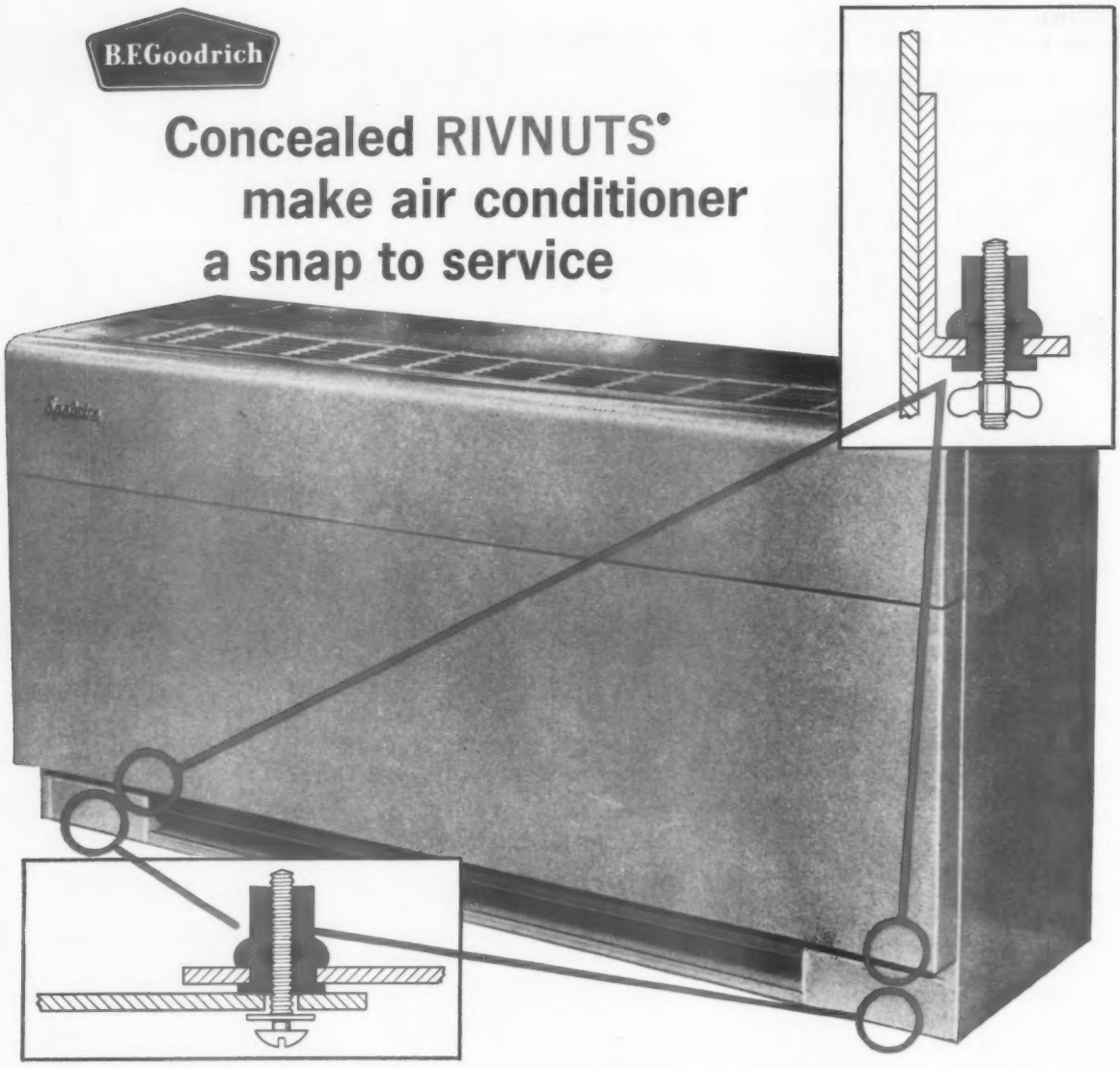
Machine Screw Department, Bridgeport 2, Connecticut

See the Hubbell Fastener Catalog in Sweet's Product Design File 7/Hu.

Use postpaid card. Circle No. 225

B.F.Goodrich

Concealed RIVNUTS® make air conditioner a snap to service



RIVNUTS help achieve the compactness and convenience featured by the makers of this room air conditioner, Drayer-Hanson Div. of Crane Co., Los Angeles.

The smooth appearance is not interrupted by visible fasteners. Concealed RIVNUTS under the bottom panel permit fastening panel to frame with wingnuts. Thus fan assembly and controls are accessible without use of tools. RIVNUTS in the base of the unit accommodate leveling bolts, which facilitate installation.

RIVNUTS are ideal for providing an adequate number of screw threads in thin sheet metal applications like this. At least six threads are available, to assure a sturdy attachment. RIVNUTS can be installed by one person, from one side of the work, in a few seconds with a heading tool.

If you'd like recommendations on a specific fastening problem, please send a print of your part.

You can improve fastening in sheet metal, tubing, tanks with RIVNUTS

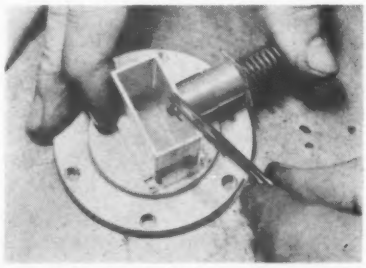
New data booklet describes principle, typical applications of RIVNUTS, lists size and tool data. For free copy write Dept. AE-9, *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

See Sweet's Product Design File

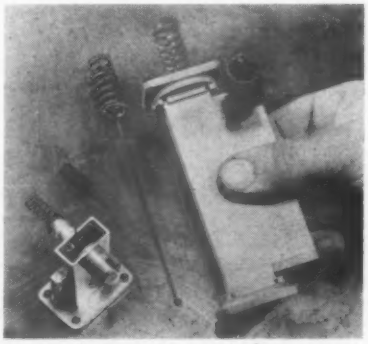
B.F.Goodrich Rivnuts

Use postpaid card. Circle No. 226

SPRING FOR CLAMPING BRASS PARTS GOOD AS NEW AFTER 1400° BRAZING



Threaded collar is held against rectangular waveguide tube by applying spring and slipping a wire through hook in spring end.



Parts are held together for 1400°F brass brazing and 1100°F aluminum brazing with springs.

After preheating, complete assembly is dipped in brazing bath.

A new alloy spring wire, NS-25, made by National-Standard Company, is "good as new" after hundreds of operations as a clamping device for brazing brass parts at 1400°F. Assembly is simplified, faster and more precise, reports the N.R.K. Mfg. and Engineering Company, Chicago, producer of microwave assemblies and radar components.

Until spring materials could be obtained that would retain tension while immersed in brazing baths up to 1400°F, N.R.K. had to use weights, intricate fixtures and tack welding in brazing parts. The spring assembly technique had been impossible for brass brazing until NS-25 springs were tried. Though springs were available at 1100°F for aluminum brazing, the technique was costlier because the springs that were used deformed quickly. Stainless steel had to be reshaped after each use, and had to be replaced after 60 or 70 brazing operations. The NS-25 springs never need reshaping.

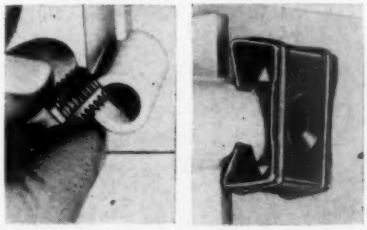
The mechanical stability of the NS-25 spring wire insured proper expansion of the parts during heating. If spring tension is too great, brazed parts will deform under spring load. If tension is too small, mating parts will not make good contact and an imperfect bond will result. Typical tolerances required are $\pm$ .002".

Brazing operations are identical in many respects for brass and aluminum parts. The parts to be brazed are assembled and held in place by NS-25 springs. Typically, one end of the spring bears directly against a small place that squeezes down on the parts. The other end of the spring is brought through the center of the helix and out through the other end. This end of the spring is secured by slipping a notched plate over a bulbous knob on the spring end.

During assembly, a shim of brazing material may be placed between the parts, or a liquid brazing compound may be applied at the junction. The assemblies are then hung on hangers or set in perforated tote baskets. They are preheated at 1000°F for 15 to 30 minutes and then immersed in a salt bath for a few minutes to be brazed.

SPRING CLIP AVOIDS FRACTURING PLASTIC PANEL

In the assembly of a table model radio, fracture of a plastic front



Self-tapping bushing (left) fractured radio's plastic panel. Spring clip (right) solved fastening problem.

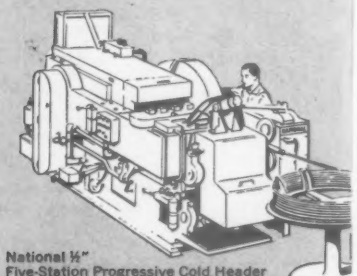
panel was occurring when a self-tapping bushing was driven into a molded boss. This internally threaded bushing accepted a bolt which fastened the front and back panels together.

continued

These important parts are cold-formed from wire, start to finish in compact, efficient National Cold Headers.

Practically scrapless, all these parts achieve remarkable savings over past methods.

If you make odd-shaped parts, may we help you evaluate them for cold-forming from wire? Better yet, come to Tiffin, witness our demonstrations and let's discuss your work.



National ½" Five-Station Progressive Cold Header

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U.S.A.

HARTFORD DETROIT CHICAGO

Use postpaid card. Circle No. 227

The manufacturer turned to George K. Garrett Co., Inc., Philadelphia, for a fastener to eliminate the breakage. A high carbon spring steel part was designed with four points of engagement to anchor the clip to the plastic boss. It was also formed with a cone impression to accept the machine bolt, and heat treated to a hardness of maximum resiliency to eliminate fracture.

Not only has the clip cut costs by requiring no special attaching tools, but also, because of its spring "give", permitted greater tolerances in the molding of the bosses.

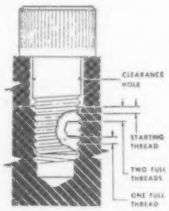
STICK SOLDER CUTS WINDOW ASSEMBLY TIME 40 PERCENT

T.J.C. Home Products Ltd. of Weston, Ontario, manufacturers of aluminum storm windows and screens, reduced window assembly time from five minutes to three minutes by soldering. Production cost on mechanically joined windows was 8¢ per corner for materials. Soldering melted the figure down to 2¢ per corner. Extended field testing indicated no anodic reaction and excellent weathering characteristics.

The results were achieved by a fluxless aluminum stick solder rubbed directly onto the joint at 720°F. The All-State solder produced bonds of 20,000 psi tensile.

LOCK SCREWS LICK VIBRATION FAILURES IN TOOLING INDUSTRY

When Ford Motor Company's Metal Stamping Division plant at Monroe, Mich. ordered a complete set of 1959 bumper dies from a Grand Rapids tool and die firm, the order carried a new specification — screws were to be self-locking. When 1960 and 1961 orders were placed, self-locking screws were again specified.



This indicates industry's increased concern with the maintenance and production headaches caused by fasteners working loose under shock and vibration.

Recently, tool and die shops and machine tool makers and users have been making major inroads on the problem. One type of self-locking screw makes use of a nylon pellet to insure positive holding power. Seated in a small recess near the fastener point, the pellet compresses as the screw is inserted in a tapped hole or nut, forcing mating threads together for positive gripping.

Because the Nylok pellet retains its resiliency, these fasteners are reusable repeatedly, will stay locked at any depth and need not be seated.

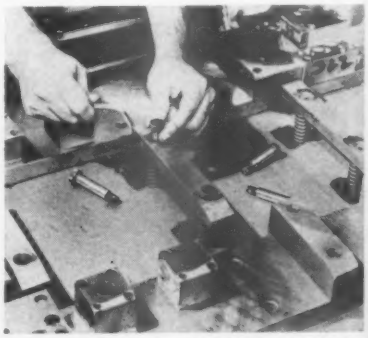
Engineers at the Ford plant report that conventional screws, particularly on slides and wear plates, kept coming loose all the time. If a screw breaks it would conceivably smash the whole die. At the least, keeping them tight was a constant maintenance problem. Now, self-locking screws are still checked occasionally, but nothing like before.

Pratt & Whitney's Machine Tools Division at West Hartford, Conn., solved a serious problem by putting Nylok set screws on all set screw-jacked, wedge-equipped milling cutters.

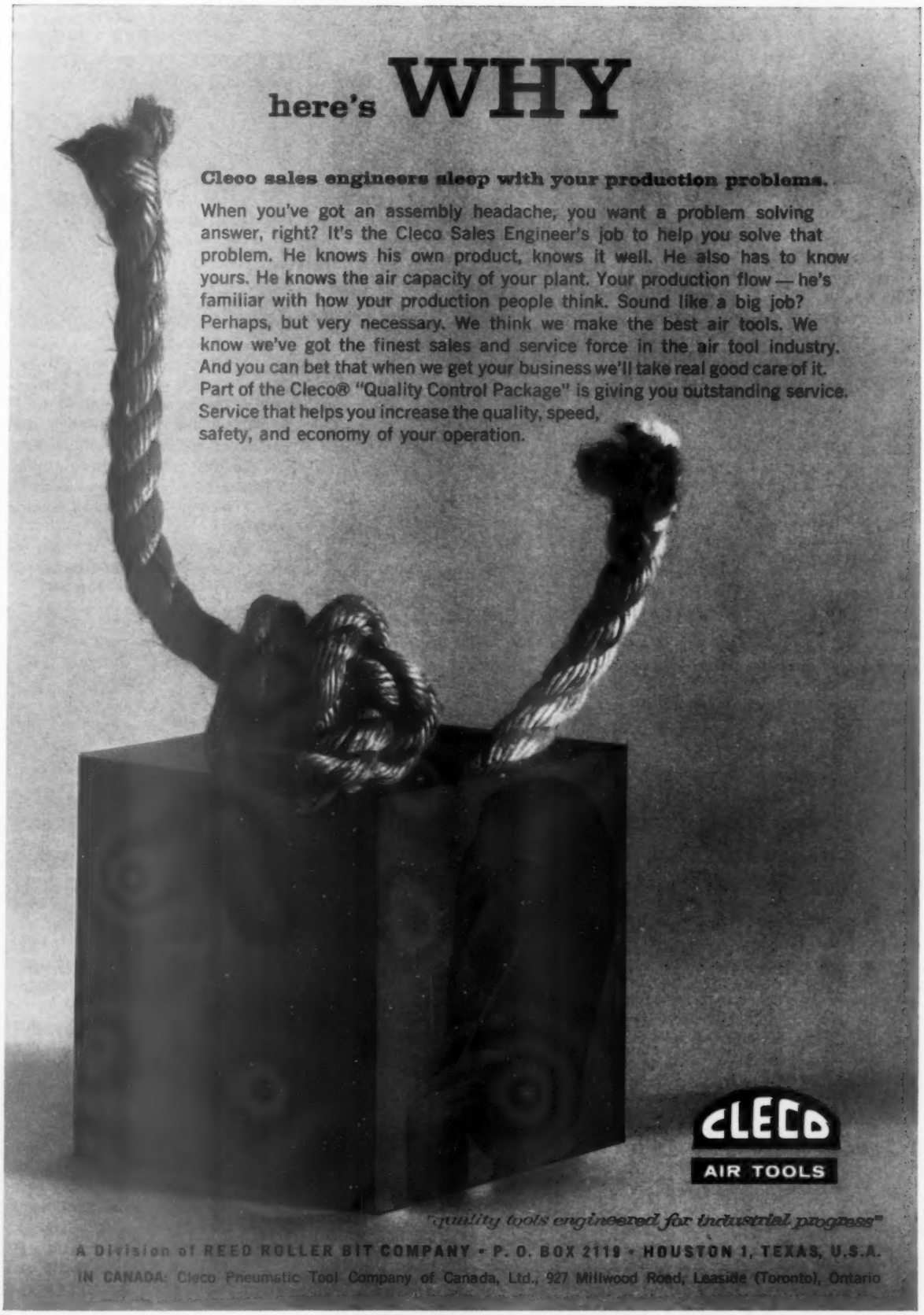
The problem arose, explains Dick Smith, chief tool engineer, when a job calling for milling and slotting of alloy steel of Rc 38-43 caused trouble with screws loosening on a set of cutters.

As a direct result of Pratt & Whitney's finding, the supplier,

continued



Increasingly specified for tool and die machinery applications are self-locking fasteners like these shoulder screws with nylon pellet.


here's WHY
Cleco sales engineers sleep with your production problems.
When you've got an assembly headache, you want a problem solving answer, right? It's the Cleco Sales Engineer's job to help you solve that problem. He knows his own product, knows it well. He also has to know yours. He knows the air capacity of your plant. Your production flow — he's familiar with how your production people think. Sound like a big job? Perhaps, but very necessary. We think we make the best air tools. We know we've got the finest sales and service force in the air tool industry. And you can bet that when we get your business we'll take real good care of it. Part of the Cleco® "Quality Control Package" is giving you outstanding service. Service that helps you increase the quality, speed, safety, and economy of your operation.
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ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

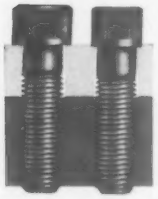
Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine* Allens (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

Only *genuine* Allens have Leader Points that make starting easier, and greatly minimize danger of cross threading. *Genuine* Allens are "pressur-formd" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

Write for samples and engineering data. See how *genuine* Allens will make your product better.

ALLEN HEX-SOCKET SCREWS HEAD

Allen's new 1960 Series Socket Head Cap Screws give up to 2½ times more load carrying capacity, without indentation. Head diameter of sizes from ¼" up is now uniformly 1½ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.



Stocked and sold by leading Industrial Distributors everywhere

50 ANNIVERSARY YEAR ALLEN HEAD 1910-1960

ALLEN MANUFACTURING COMPANY

HARTFORD 1, CONNECTICUT, U.S.A.

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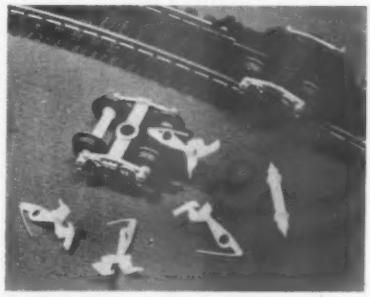
Lovejoy Tool Co., Springfield, Vt., has adopted nylon-pellet screws as standard for all the slotting and side milling cutters of this type it produces.

Other firms also report excellent results.

Friedrich Refrigerators, Inc., Cleveland, put in SPS Unbrako cap screws on drill heads for machine tools—and eliminated the extra trouble and expense of force-fitting screws into holes tapped undersize for tightness.

Once, Bowers Mfg. Co., Inc., of Los Angeles, had to check three or four times a day on tightness of the screws used in their tools and dies. Since changing to stripper bolts with the nylon locking feature, they report dies now operate as much as 200,000 cycles without requiring any maintenance whatever.

HOW LIONEL REDESIGNED ASSEMBLY INTO ONE PART



Spring couplers, as well as axles, in Lionel's new train line are molded of Delrin.

When the new HO model train line was being developed at The Lionel Corp., Irvington, N.J., engineers saw where assembly costs could be cut by redesigning a coupler as one piece. But they had to find a material with properties to do the job of the present two-part assembly—a nylon coupler and steel coil spring.

Delrin, an acetal resin plastic, was chosen for its high tensile and impact strength, dimensional stability and high elasticity. This last property (average flexural modulus: 410,000 psi) became especially important to duplicate the steel spring's action.

For production savings, the couplers are high-speed molded by Gries Reproducer.

METAL STITCHING SPEEDS AIR DUCT FABRICATION

Metal stitching proved to be three times faster than previous assembly methods in fabricating sheet metal ducts.

To fasten various sheets of galvanized steel into air conditioning-type ducts for use in hot air furnaces, the Minneapolis Branch of U.S. Register Company has turned to metal stitching.

Replacing double-seaming (interlocking) and welding, the Bostitch S13E uses 18 gauge, 330 galvanized wire and penetrates up to two thicknesses of 22 gauge steel. The unit is capable of driving up to 295 staples per minute.

According to Roy Hogoboom, branch manager, the stitcher is "particularly suited to our operation because it produces tight-fitting connections, clear-cut penetration and a tight, flat clinch. It is many times faster than our former methods."

SWITCH IN HEADING STEELS BOOSTS FASTENER OUTPUT

C. S. M. Screw Products Co., Chicago, got a 50% increase in the production of cold headed inserts by careful selection of materials.

A new product, the insert has a split head collar of stainless steel that is molded into a plastic housing with threaded end extended.

Initially, the insert was made from carbon steel and brass. Then it was produced from stainless steels for high strength. The original stainless grades, in particular, caused premature galling of dies and non-uniform parts. The inserts are now made from Carpenter stainless No. 10 and type 430 stainless grades without any hitch in production. •

ASSEMBLE PARTS FASTER . . . WITH FEWER REJECTS!

DPS model U power screwdriving machines

- Maintain constant driving torque with new positive control clutch
- Dependable motorized hopper drive with safety clutch protects motor and gears in the event of jamming
- Release screw by body or head with new feed track and escapement mechanism

Write today for DPS Model U Bulletin

You can drive up to 40 screws per minute with a DPS Model U. Nuts are driven equally fast . . . with accuracy that cuts parts waste, improves assembly quality.

DPS offers the Model U in two types: pedestal, and self-contained driving head. Both require minimum space and are readily adaptable to your work flow. Feed track and escapement mechanism mounts on either side of the machine column for right- or left-hand assembly. The versatile self-contained driving head is ideal for use in automatic assembly machines incorporating dials and straight-line transfers.

The Model U drives screws from #6 x 3/16" long to 1/4" x 1 1/2" long . . . and can be equipped with 12" or 16" barrel feeders.

DETROIT POWER SCREWDRIVER COMPANY
2815 W. Fort St. • Detroit 16, Michigan
A Subsidiary of Link-Belt Company
15,334

Use postpaid card. Circle No. 230

by **E. B. Palmer**
Senior Design Engineer
Convair Division
General Dynamics Corporation
Fort Worth, Texas

HOW LUBRICATION AFFECTS

LUBRICATED TORQUE REQUIRED TO DEVELOP THE DESIRED TENSION LOAD ON FASTENERS USING MIL-T-5544

STEEL (LOW ALLOY) WITH ALLOY STEEL OR ALUMINUM NUTS

FASTENER SIZE & THREADS PER INCH	INDUCED TENSILE STRESS												
	30 KSI	40 KSI	50 KSI	60 KSI	70 KSI	80 KSI	90 KSI	100 KSI	110 KSI	120 KSI	130 KSI	140 KSI	150 KSI
1/4 -28	26	30	36	42	48	55	62	69	75	82	89	94	100
5/16-24	50	60	72	90	112	120	140	155	170	200	220	250	270
3/8 -24	84	100	130	162	175	204	240	275	306	335	368	390	425
7/16-20	140	202	235	265	280	300	350	400	450	500	560	620	710
1/2 -20	150	290	365	400	491	540	600	670	723	890	967	1,034	1,100
9/16-18	200	295	380	438	590	700	780	838	900	990	1,080	1,200	1,370

Use charts 8 through 13 for sizes 5/8-18 through 1-1/4-12.

CRES BOLTS WITH CRES NUTS

FASTENER SIZE & THREADS PER INCH	INDUCED TENSILE STRESS												
	30 KSI	35 KSI	40 KSI	45 KSI	50 KSI	55 KSI	60 KSI	65 KSI	70 KSI	75 KSI	80 KSI	85 KSI	90 KSI
1/4 -28	48	60	72	75	84	90	101	103	108	114	126	135	144
5/16-24	72	84	96	108	120	132	144	161	174	188	200	216	228
3/8 -24	72	90	105	112	141	150	162	180	198	216	232	252	270
7/16-20	188	216	240	252	288	276	348	372	396	420	450	480	504
1/2 -20	264	300	348	384	432	480	516	552	588	612	660	708	756
9/16-18	480	540	588	648	720	780	852	924	996	1,056	1,140	1,212	1,260
5/8 -18	526	600	684	756	840	924	996	1,092	1,188	1,272	1,380	1,476	1,572
3/4 -16	876	996	1,176	1,296	1,440	1,596	1,716	1,896	2,100	2,256	2,436	2,604	2,796
7/8 -14	2,472	2,796	3,048	3,300	3,564	3,960	4,248	4,656	5,004	5,400	5,904	6,360	6,804
1 -14	2,580	3,072	3,300	3,696	4,104	4,656	4,956	5,400	5,856	6,300	6,852	7,404	7,896
1-1/8 -12	4,056	4,704	5,352	6,000	6,564	6,072	7,704	8,304	8,940	9,516	10,176	10,800	11,448
1-1/4 -12	5,088	5,844	6,552	7,296	8,076	8,844	9,600	11,376	11,700	12,240	13,404	14,700	15,600

TITANIUM BOLTS WITH ALLOY STEEL OR ALUMINUM NUTS

FASTENER SIZE & THREADS PER INCH	INDUCED TENSILE STRESS												
	30 KSI	35 KSI	40 KSI	45 KSI	50 KSI	55 KSI	60 KSI	65 KSI	70 KSI	75 KSI	80 KSI	85 KSI	90 KSI
1/4 -28	21	24	30	33	36	42	48	49	51	57	60	64	66
5/16-24	54	60	76	84	96	104	128	129	135	144	156	162	177
3/8 -24	66	81	87	96	114	126	150	153	162	168	186	192	213
7/16-20	162	180	240	276	312	356	390	396	468	501	546	585	270
1/2 -20	258	300	360	408	456	504	552	600	660	720	768	816	864
9/16-18	324	384	462	540	576	648	708	780	840	900	960	1,020	1,092
5/8 -18	432	504	576	648	720	792	864	936	1,008	1,080	1,032	1,224	1,308
3/4 -16	660	780	924	1,044	1,140	1,224	1,332	1,488	1,584	1,680	1,740	1,884	1,980

Note: Approximately 65% of ultimate is considered ideal for conventional torque-wrench tightening. All torques are given in pounds-inch.

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A report on an extensive Convair research program concerned with factors affecting the torque-tension relationship, and especially the use of lubrication on bolts.

TORQUE-TENSION RELATIONSHIPS

The deceptively simple aircraft bolt is a hot-bed of surface and internal stresses. And ironically, though it represents so minute a fraction of a project's cost, the causes of many catastrophies have been traced to a fastener. For example, the fiery explosion of a missile on its launching pad at Cape Canaveral last December was caused by fasteners. The investigation disclosed that vibrations, caused by loose hold-down bolts, set up when the missile's first-stage engines were fired, caused a small electrical relay to "chatter". This in turn accidentally closed a circuit activating the missile's self-destruction mechanism and the spectacular failure occurred.

When we consider the importance of the role that so small a part plays not only in the aerospace industry but in industry as a whole, it is logical that we ask, "Why isn't more being done to unlock the secrets of the fastener?" At our plant we recognized early in the design of the supersonic B-58 Hustler that variable factors, improper assembly, and subsequent failure of bolts in the field would have to be eliminated. This recognition sparked a tremendous amount of research and development with the objective of learning to control torque-tension relationships in fasteners on every torquing. The test series also proved that, by being able to accurately control the torque-tension relationship, a designer could specify a smaller bolt under a higher stress to save weight. Also, in many cases, a smaller fastener can give a stronger assembly at less cost.

A properly installed fastener is one that has an induced tensile stress in the bolt that is greater than the outside load that it supports in service. When this situation exists in a bolted assembly, the fastener cannot fail by fatigue. This is because there is no change in tension stress, regardless of the changes of the operating load. It can however, fail from other causes, some of which will be discussed later in this article. Still, this is an ideal fastener condition, and one that can be achieved under proper control.

Controlled torque-tension relationship is strictly a phase of very complex engineering. In Convair's investigation, which began several years ago, it became increasingly apparent that progress had been slow in this phase of engineering. The delayed recognition of the seriousness and complexity of the problem, as well as a tendency on the part of engineering as a whole to place the responsibility on the various fastener manufacturers, seemed to account for the retarded development.

Aerospace projects are far too important to permit the designer to assume that any fastener will perform faultlessly simply because it meets a particular specification. It is more important that the fastener, besides meeting the specification, is in-

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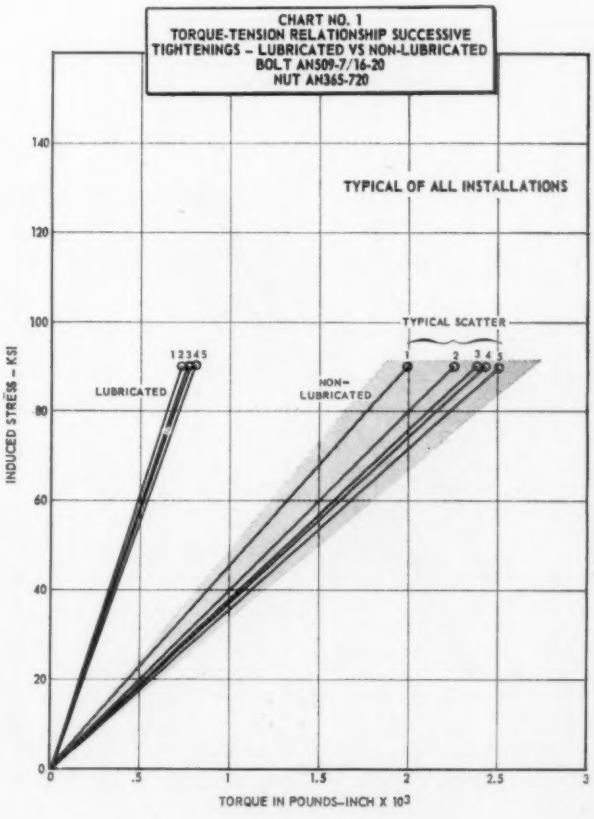

stalled in such a manner that the induced tensile stress is within the limits of the design and that full advantage is taken of the rated minimum ultimate tensile strength of the particular fastener. In too many cases the designer calls for a high tensile strength bolt, then loads it to only a fraction of its potential.

This article will not attempt to cover the many facets of the several complex phases of fasteners. It is intended to cover only that portion of the science which deals with specifying and achieving, in practice, a predictable and proper induced tensile stress (preload) consistently for bolts loaded primarily in tension. Although the values given will work under any application, the importance of proper preloading is relatively less severe with fasteners that are used in shear applications. Many factors affect the torque-tension relationship of a fastener. By far the most important is the lubricated or unlubricated condition of the bolt. The torque-tension relationship, under conditions of dry torquing, is a function of many variables, most important of which are:

(a) The type of metal, the hardness and the surface finish of the structure to be bolted.

(b) The geometry and surface finish of the head and nut bearing surfaces, i.e., the angularity between the bearing face of the nut and the pitch of the threads.

(c) The hardness and the plated or unplated condition of the bolt and nut.

(d) The number of successive tightenings.

(e) The clearance of the hole drilled for the fastener.

In order to maintain the same stress level in unlubricated fasteners after each successive tightening, it is necessary to gradually increase the torque value. The required increase in torque is caused by: galling of the head or nut seating surfaces, and galling of the threads between the nut and bolt.

Our tests indicated that galling of the head or nut seating surfaces accounted for a far greater percentage of increase than galling of the threads. General opinion before testing was the reverse of this. Lubricated condition torquing produces average torque-tension relationships which do not vary appreciably over repeated torquings to high tensile stress levels. The variables that are so damaging to dry conditions do not play an important role in the case of lubricated torquing, especially when the lubricant is MIL-T-5544 compound.

Due to the great variation in the torque-tension relationship in unlubricated bolts, achieving a proper and predictable preload in practice is highly unlikely. In searching through the test data from many manufacturers, from WADD, from independent testing organizations, and from Convair's Engineering Test Laboratory, it has been determined that a varia-

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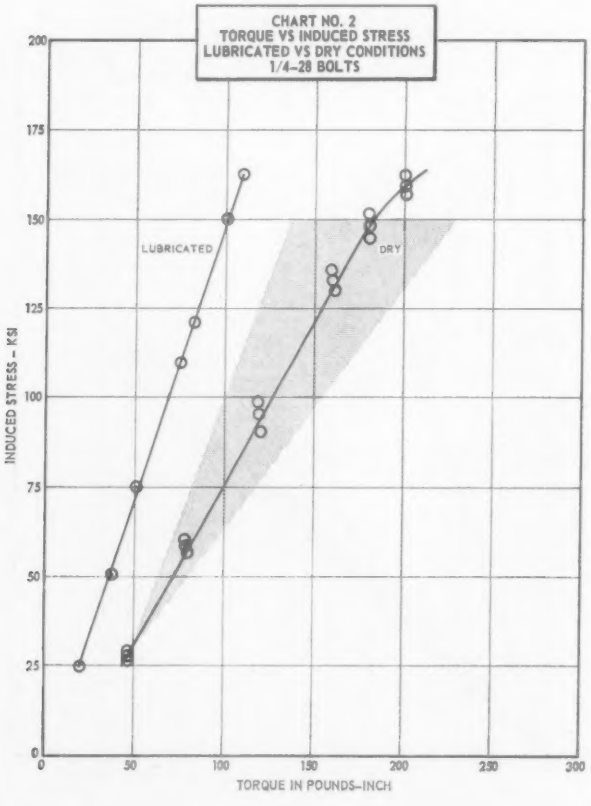

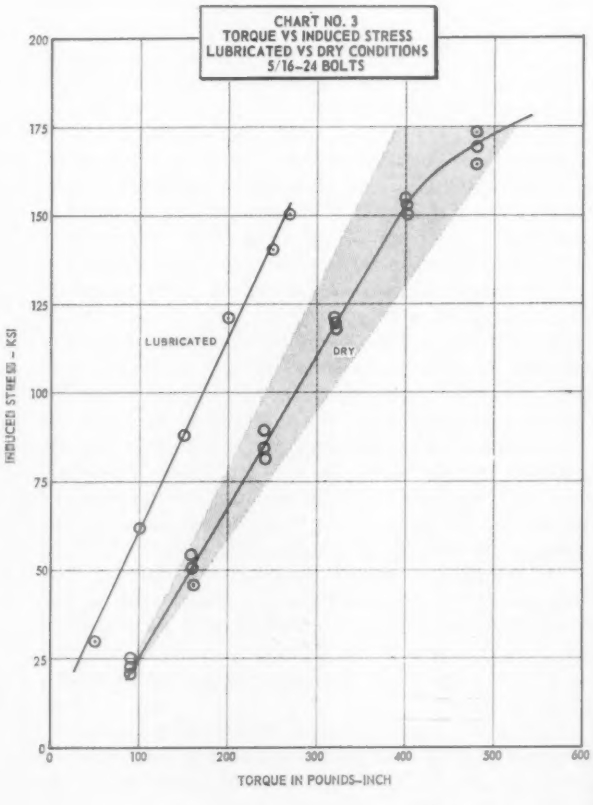

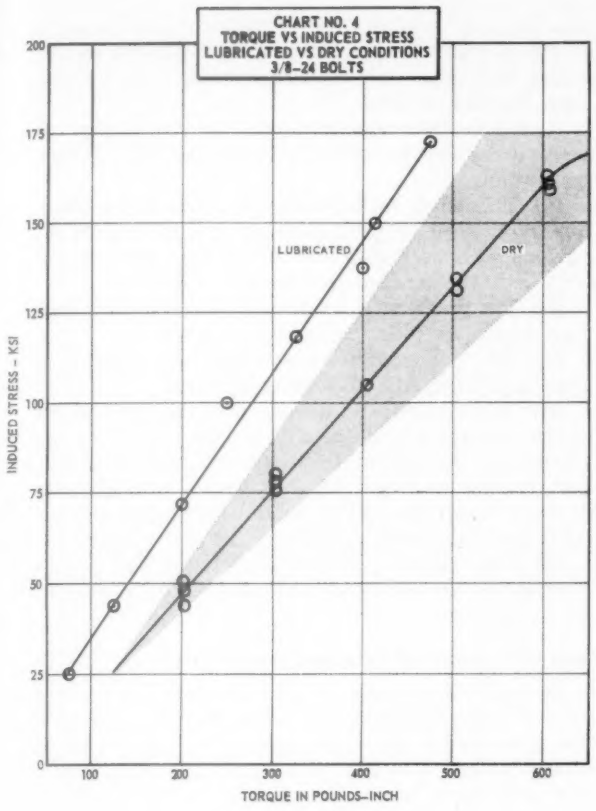
CHART NO. 4
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
3/8-24 BOLTS
INDUCED STRESS - KSI
TORQUE IN POUNDS-INCH
LUBRICATED
DRY

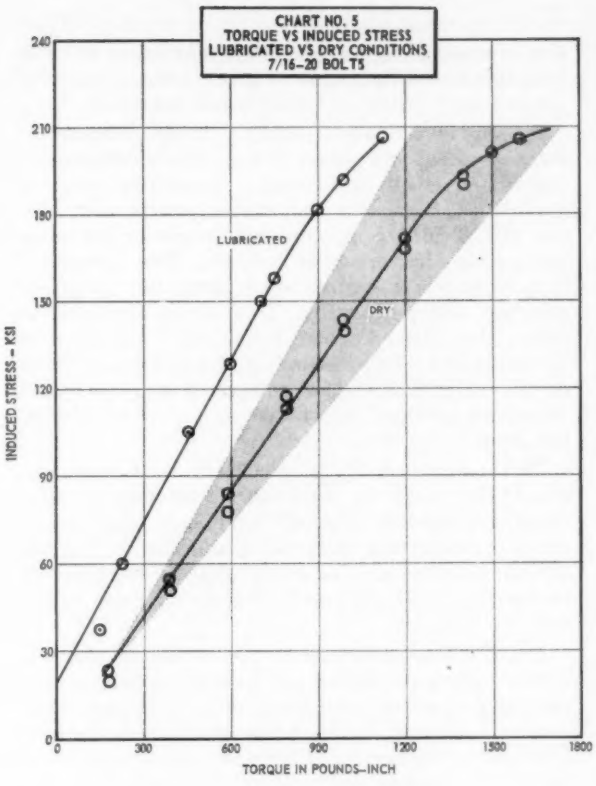
CHART NO. 5
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
7/16-20 BOLTS
INDUCED STRESS - KSI
TORQUE IN POUNDS-INCH
LUBRICATED
DRY

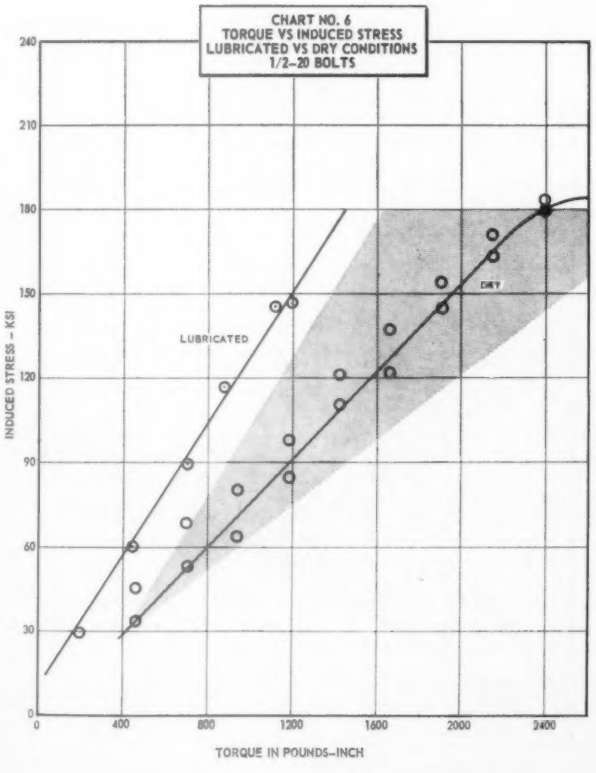
CHART NO. 6
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
1/2-20 BOLTS
INDUCED STRESS - KSI
TORQUE IN POUNDS-INCH
LUBRICATED
DRY

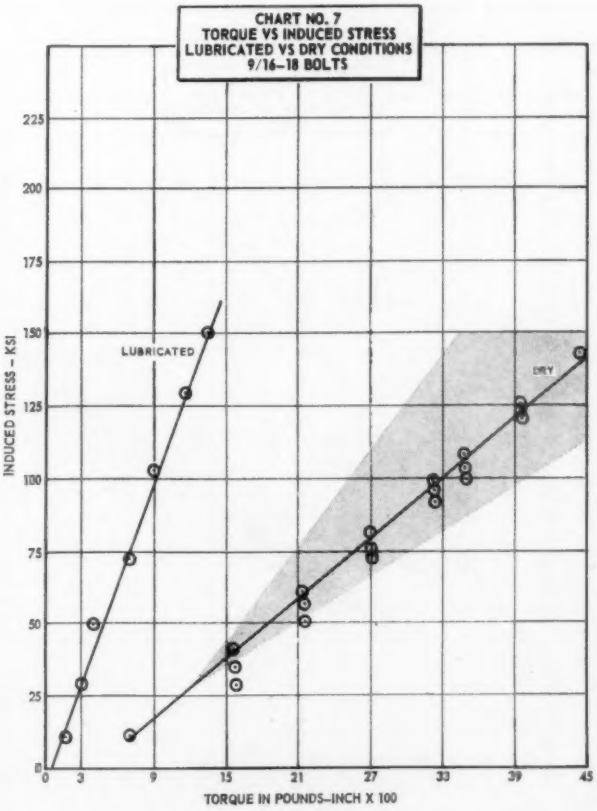
CHART NO. 7
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
9/16-18 BOLTS
INDUCED STRESS - KSI
TORQUE IN POUNDS-INCH X 100
LUBRICATED
DRY

tion in stress of as much as 200% may occur in identical specimens tightened to given torque values if the fasteners are in an unlubricated condition.

In our investigation, many "thread lubricants" were screened and tested. It was finally determined that for over-all performance, simplicity, ease of application, consistent predictable results, cost, etc., the MIL-T-5544 compound was superior for most applications in aerospace projects. This compound is a simple mixture of equal parts by weight of graphite and petrolatum. This is not intended to imply that other "thread lubricants" are inferior. However, the data presented in this article are based on the use of MIL-T-5544 compound and these data cannot be assumed to conform to any other "thread lubricants".

This compound is an electrical conductor and should therefore be used with discretion in electrical equipment. For all practical applications, when a conducting material is undesirable, molybdenum disulfide may be substituted for the graphite in the compound and approximately the same values will be obtained.

MIL-T-5544 compound is not generally suitable where sealing properties are desired. In cases where sealing properties are necessary in a thread lubricant and release agent, it has been determined by Convair's Engineering Chemical Laboratory in a series of elaborate and conclusive tests that the use of unfused Teflon plastic film, pressure sensitive adhesive tape is superior to any material tested up to 500°F and 6,000 psi. Torque values shown in the tables and charts of this article may not be used with the Teflon tape.

A few simple requirements are necessary to receive the full benefits of the use of MIL-T-5544 compound:

(a) The parts to be coated must first be thoroughly cleaned on each installation with a suitable solvent such as P-S-661 or VV-K-211, then wiped dry with a clean lint-free cloth.

(b) The parts must be visually inspected for any rust, burrs, irregularities or rough surfaces.

(c) When the parts to be coated are clean and dry, apply the MIL-T-5544 compound.

(d) MIL-T-5544 compound must be applied to every friction surface of a bolt assembly. This includes the threads, and all bearing surfaces of the nut, washer and bolt head as shown in Figure 1. It must be applied on the initial tightening and on all subsequent torquings due to loss of the lubricant.

(e) Application of the compound may best be accomplished by using a stiff bristled brush, a spatula, or by hand.

WHAT ABOUT SELF-LOCKING NUTS?

On self-locking nuts or bolts, the torque required to overcome this frictional force must be added to the final torque shown in the tables and charts of this article. Likewise, when torquing bolt heads, the bolts must have a hand press fit, or the force required to rotate the bolt must be added to the

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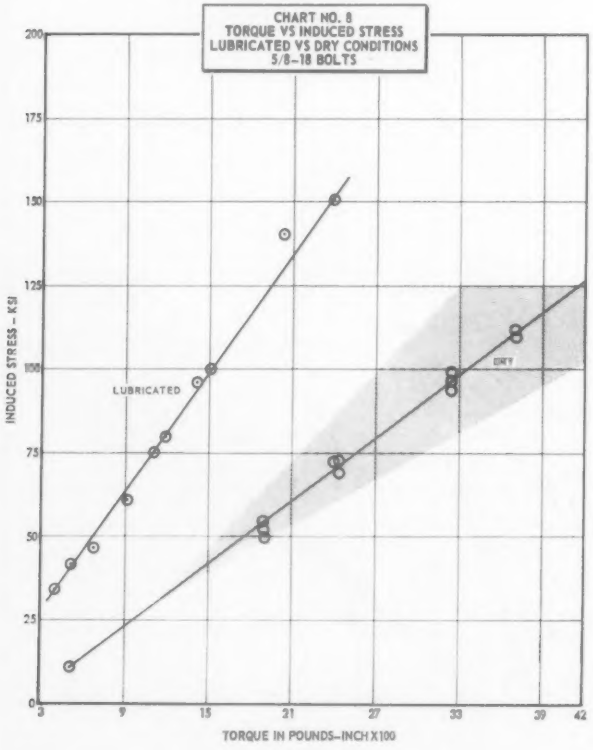
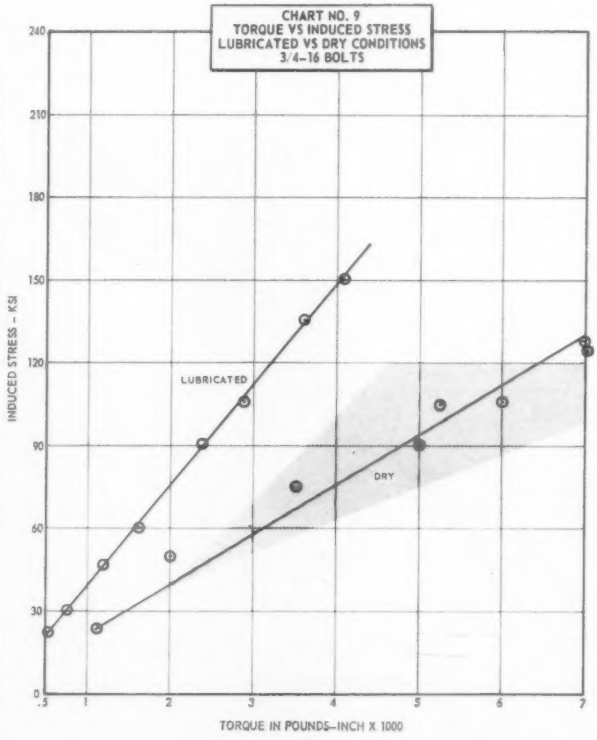




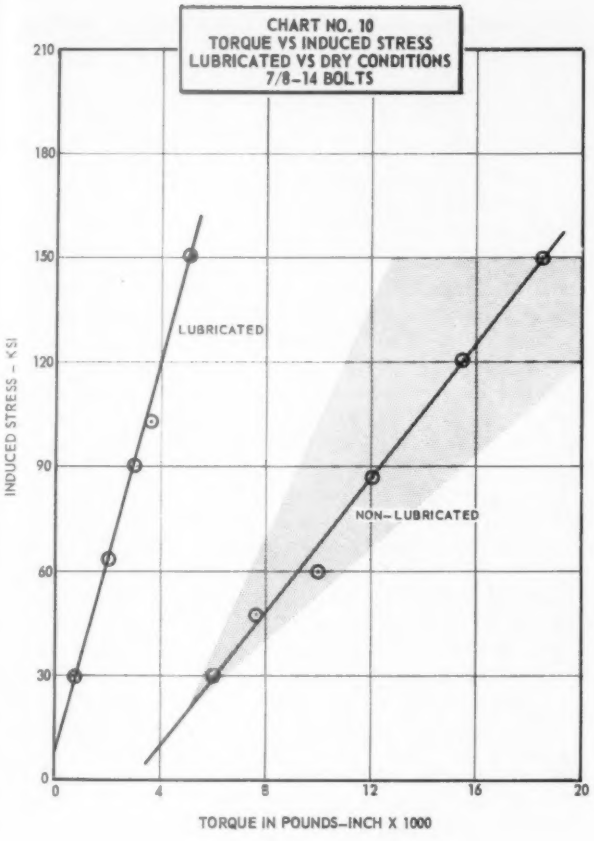


CHART NO. 10
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
7/8–14 BOLTS
INDUCED STRESS – KSI
LUBRICATED
NON–LUBRICATED
TORQUE IN POUNDS–INCH X 1000

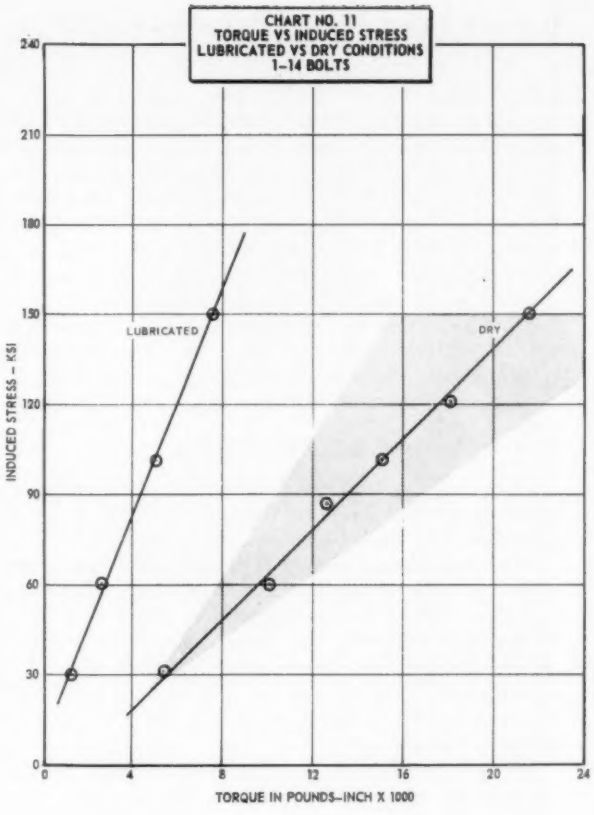


CHART NO. 11
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
1–14 BOLTS
INDUCED STRESS – KSI
LUBRICATED
DRY
TORQUE IN POUNDS–INCH X 1000

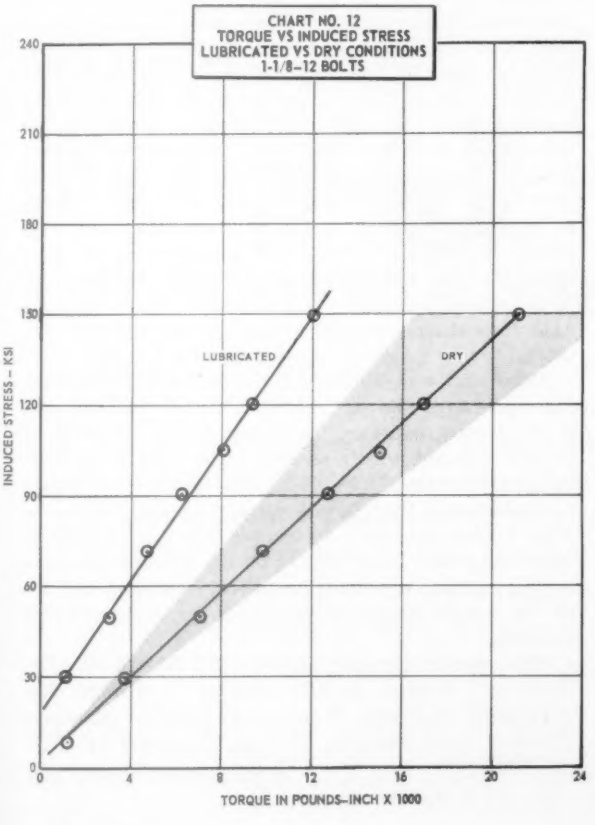


CHART NO. 12
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
1-1/8–12 BOLTS
INDUCED STRESS – KSI
LUBRICATED
DRY
TORQUE IN POUNDS–INCH X 1000

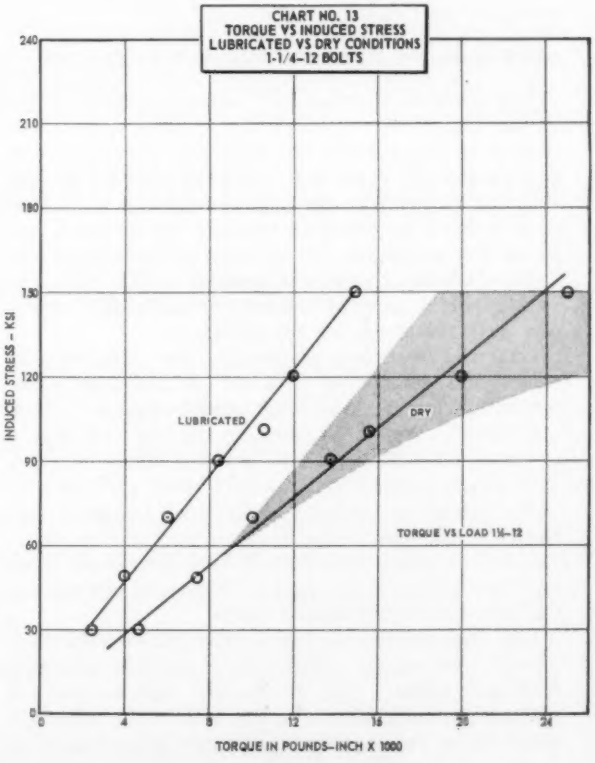


CHART NO. 13
TORQUE VS INDUCED STRESS
LUBRICATED VS DRY CONDITIONS
1-1/4–12 BOLTS
INDUCED STRESS – KSI
LUBRICATED
DRY
TORQUE VS LOAD 1¼–12
TORQUE IN POUNDS–INCH X 1000

values given. In an effort to overcome some of the variables caused by dry torquing, many of the manufacturers are using solid film lubricants of various types on threads, and, in some cases, on the entire fastener. These fasteners, when lubricated with the additional MIL-T-5544 compound, have the same properties as the regular fasteners in a lubricated condition. Therefore, the tables and charts shown may be used with these various treated combinations. Under no conditions should the torque values for lubricated fasteners and dry fasteners be interchanged because dangerous understressing or overstressing will result.

THE QUESTION OF VIBRATION

One question that so often arises in connection with using the lubricated fastener is, "Will it have a tendency to back off or loosen in service?"

Vibration testing indicates that there is no more tendency for a properly installed lubricated fastener to loosen than in a dry installation. Much test data is available to verify this statement.

The designer, by considering the bolt size, the structure to be bolted together, the material involved, etc., can arrive at the desired bolt induced tensile stress (preload).

He can be assured that this preload will be accomplished, even after repeated installations with the same bolt, if he specifies the use of MIL-T-5544 compound and optimum performance of the bolted structure will result.

DETERMINING DESIRED TENSILE STRENGTH

Determining the desired induced tensile stress is the designer's responsibility. However, in order to achieve that induced tensile stress when a fastener is installed, it is necesary that he specify on the installation drawing the torque value (in inches or pounds/foot) required to produce the preload, because the mechanic has no way of measuring the induced tensile stress in a fastener.

The table on page 36 has been prepared for a quick and easy reference for the designer.

Chart 1 illustrates graphically the difference in stress and scatter of data for MIL-T-5544 compound lubricated vs. unlubricated fasteners.

Charts 2 through 13 compare the induced tensile stress of lubricated vs. unlubricated fasteners, sizes ¼-28 through 1¼-12.

On special or custom-made steel fasteners not shown on the charts the designer may use an equation for torquing with MIL-T-5544 compound. This equation may also be used for titanium but not for CRES (corrosion-resistant steel).

The equation for torquing with MIL-T-5544 compound involves the coefficient of friction, effective frictional radius, type of threads, and number of threads per inch. This equation relates the variables involved by defining the torque vs. load relationship in a bolt tightening process. By assuming a coefficient of friction and expressing the effective frictional radius in terms of nominal shank diameter, the equation can be simplified to:

$$\frac{T}{L} = +.00555D + \frac{.0125}{N}$$

T—Wrench torque (ft. lbs)
L—Tension load on bolt (lbs)
D—Shank diameter (in.)
N—Number of threads per inch.

It will be noted in the table (under alloy steels) that the induced tensile stress levels have been carried out to 150 ksi. This high stress or preload is beyond the limits of many fasteners. It was carried up to this point to be used with the new high heat treat fasteners that have a rated minimum ultimate tensile strength of as high as 260,000 psi. It will also be noted that the charts go to 240 ksi, though most of the testing was stopped at 150 ksi. An induced tension stress load of 65% of ultimate is considered ideal in most applications. To obtain torque values higher than those shown, extrapolated values on the lubricated fasteners are accurate and may safely be used due to the almost straight line curves. In a dry condition, extrapolated values must not be used without adequate laboratory testing as the values are most unpredictable.

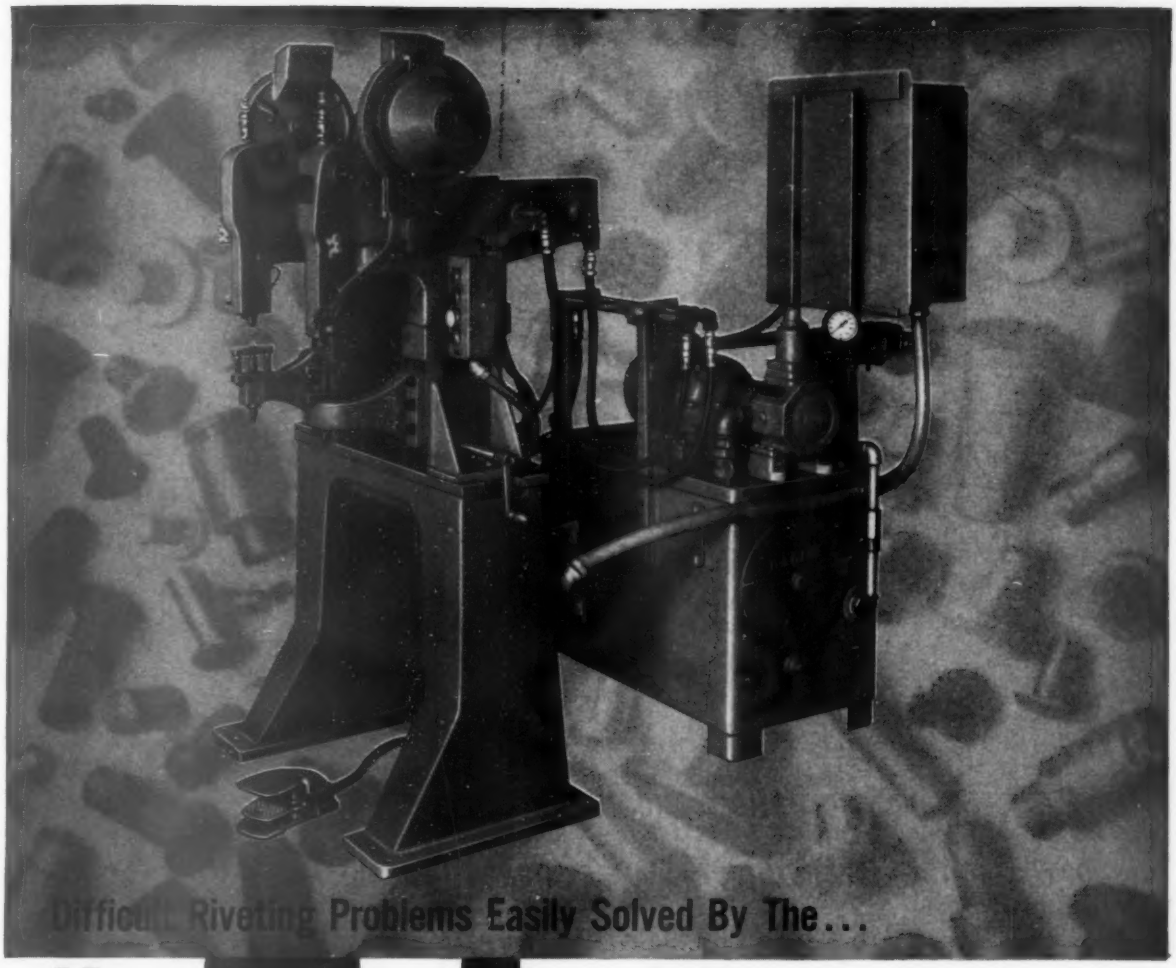
These curves are averages taken from a minimum of 10 to a maximum of 50 successive tightenings. The scatter of data in the unlubricated fasteners is shown in the shaded area. The scatter of data for the lubricated fasteners is so minor that it is not deemed necessary to illustrate by shading.

Present experience at Convair on the new high ultimate tensile strength bolts has revealed some facts that should be pointed out. One of the most important is that some fasteners have failed under induced tensile stress of only half or less of their rated tensile strength. Investigation revealed the cause to be from hydrogen embrittlement*, resulting possibly from the surface treatment of the fastener after heat treat. A fastener under tension stress is an ideal test for hydrogen embrittlement and almost identically duplicates laboratory test procedures. Although this phase of fastener engineering is outside the scope of this article, it is of such vast importance that it should be thoroughly investigated by users of these high stress bolts.

Achieving a predictable induced tensile stress on fasteners in a dry condition is an unrealistic and a dangerous practice. In order to be assured of proper induced tensile stress in fasteners, they must be in a lubricated condition. Therefore, it is highly recommended that in all structural application of bolts loaded primarily in tension, the use of MIL-T-5544 compound be called for by the designer and the torque values necessary to obtain the desired induced tensile stress be called out on the applicable drawing. •

References: Convair Report FGT-2085; WADC Technical Report 57-330; ASTIA Document No. AP131039; Convair Report FPS-0048; Standard Pressed Steel Reports; Convair Report FPS-0021.

*See "Hydrogen Embrittlement in Fasteners", July 1960, Assembly & Fastener Engineering.



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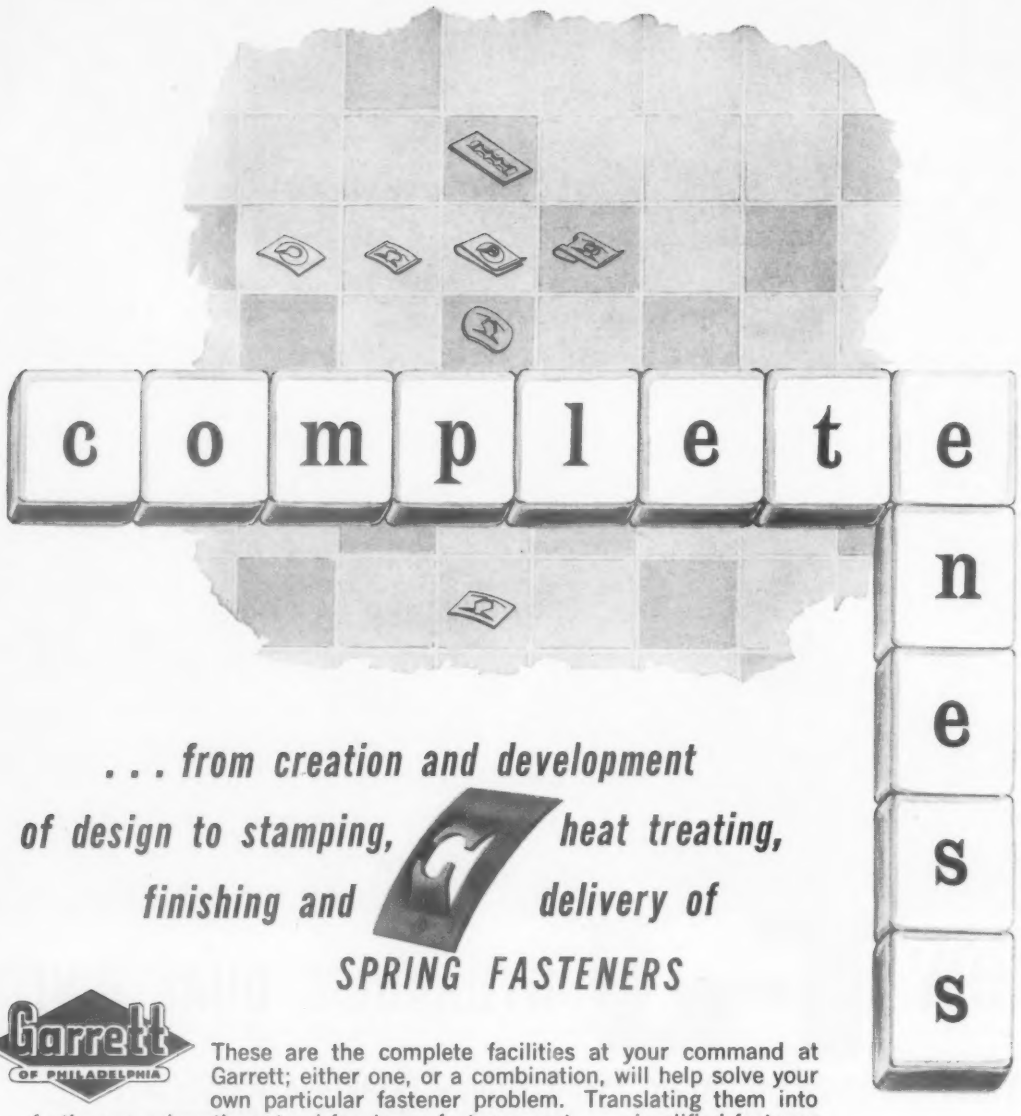

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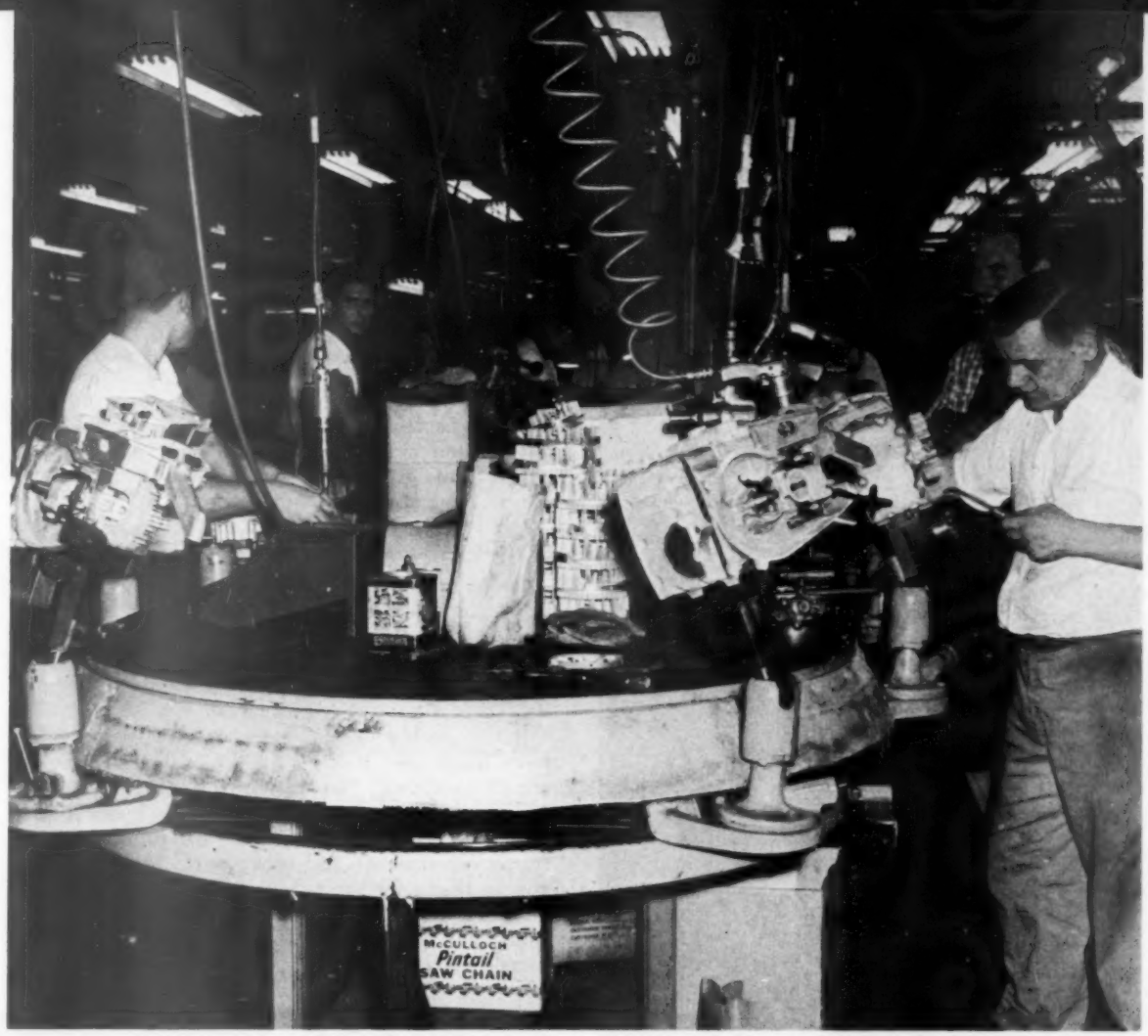

Bench-edge conveyors with ball-and-socket fixtures facilitate assembly. There are three such set-ups at McCulloch.

Power tools are suspended from superstructure over the tables. Note that one tool has self-retracting air hose.

ASSEMBLING TWO-CYCLE ENGINES

Besides employing the newest type of assembly equipment, McCulloch uses M-T-M to help balance the work load, plus a special type of incentive plan

by **Roger Taylor**
Senior Industrial Engineer
McCulloch Corporation
Los Angeles, California

Production engineers at McCulloch Corporation, Los Angeles can state with confidence that any assembly department which can efficiently turn out 1000 small but complicated gasoline engine power units a day must be as carefully pre-planned and designed as the product itself. Note that the word "efficiently" is used. This implies maximum assembly output with minimum labor input. Assembly equipment is less important costwise, for the cost of such equipment can be amortized over a period of time. But labor, once expended, is gone forever with no opportunity for recovery.

But before we expand on the techniques employed at McCulloch to obtain efficiency and labor balance

continued

Here an oil seal and a needle bearing are installed in a cylinder-crankcase component in a single operation, while maintaining locating tolerances for each part.

In this McCulloch-designed device, two piston rings are installed as the piston moves upward on a floating fixture.

In setting the breaker points in ignition system, flashing light on box indicates when the points are properly set.

throughout the assembly department, a clarification of the major problems involved is in order. Currently, ten different two-cycle gasoline engine models are made at the Los Angeles plant. These engines are used to power the chain saws, which have made the name "McCulloch" familiar throughout the world, and also for Karting installations. The ten different models are assembled in production lots, and not intermingled on the line. In addition, numerous sub-assemblies (carburetors, ignition systems, piston and ring assemblies, etc.) must be made in the forms of "spares" for outdated models which are no longer in production.

BENCH-EDGE CONVEYORS AID ASSEMBLY

This major assembly work is accomplished on three oval-shaped, bench-height conveyorized assembly lines. Also, in what might be termed a pair of finish assembly departments, non-operative parts, accessories, decals, etc. are added after the engine has been run-up tested and painted.

Sub-assembly, insofar as possible, turns out complete component systems for the engine such as the clutch assembly, the piston-ring-pin-bushing and rod assemblies, and ignition systems. In major assembly, these component systems are combined with frame components and other parts to produce an engine ready for the run-up test. After testing and painting, the finish assembly departments or stations add the non-operative parts and accessories named above.

The use of ball-and-socket fixtures, mounted on conveyor which runs around edge of assembly bench, permits positioning engines for maximum work convenience.

Masking is done after run-up testing and just prior to prime painting. This is to keep certain surfaces free of paint to facilitate subsequent component additions.

With such a variety of assembly work, office-generated paper work control is a necessity. This paper work defines the number of engines to be assembled in a given production lot. This in turn controls the number of given parts supplied along the assembly line so that when a production lot is completed, all parts have been used up and none need be returned to stock. This same paper work guides the setting up of the assembly line, tooling it, and providing the right number of workers when a changeover occurs.

METHODS-TIME-MEASUREMENT STUDIES

Balancing of the work load between the assembly stations so that no one man has to wait for work while another must push himself to keep up is accomplished by Methods-Time-Measurement studies.

In these M-T-M studies, an assembly station is chosen where the work cannot be further subdivided, yet requires more time to accomplish than any other assembly job. This is called the "control" station. The amount of work provided other assembly stations is then brought up to time requirements equal to that of the control station. The maximum differential of time requirements between assembly work stations is set at five percent, though with mounting experience, McCulloch industrial engineers are now able to substantially reduce this figure.

An M-T-M work sheet is provided for each model of engine produced. This sheet specifies the number of engines that must be assembled in an hour to maintain what is called "100 per cent production". This figure is predicated upon normal working speed, including 32 minutes per shift rest or relief time

At final assembly station, painted engines are removed from paint line conveyor. Here are added such parts as the handling bars, exhaust stacks and cover plates.

for each employee. A relief man on each line "fills in" for each assembly line employee during this allowable relief time.

The 100 per cent production figure on each M-T-M sheet is predicated upon average working speed. If the employees on a specific line wish to increase their working speed, thus assembling more engines than called out by the 100 per cent production figure, they are paid a bonus accordingly. Thus, in reality, an incentive system exists. But in this case, the system is policed by the employees themselves. It is up to them whether or not they want to exceed the 100 per cent production figure. To date, this system has worked out very satisfactorily.

To deviate from assembly control to actual assembly work, it should be pointed out that at McCulloch, most of the automatic and semi-automatic assembly machines now in use are found in the sub-assembly

continued

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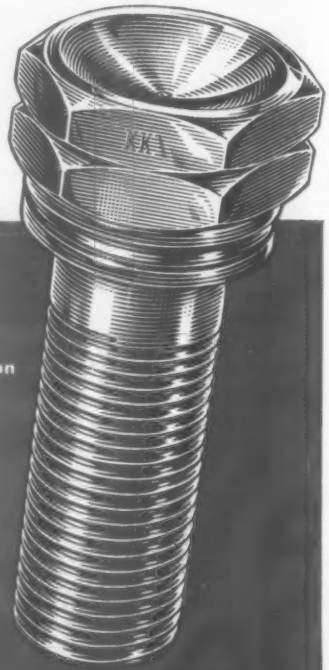

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Assembling Two-Cycle Engines, continued

department. Some of these machines are highly specialized in use. For instance, one McCulloch designed and built bench machine installs two piston rings on a piston in a single operation. This was a slow and cumbersome task when accomplished by hand.

Another company-designed, semi-automatic bench machine is equipped with a floating fixture. This machine installs piston pin bushings in the piston so accurately that spacers are no longer needed to prevent connecting rod side play. Bushing centering is automatically accomplished within .004 of an inch. Another bench machine automatically installs the high tension garter spring which holds the centrifugal clutch segments together until, during engine operation, centrifugal force forces them outward against garter spring tension. Automatic riveting machines are used wherever applicable, and induction heaters are used for some types of brazing and silver soldering. In many cases, such as during subassembly of the ignition system, complete tests and check-outs are run before the sub-assembly reaches the major assembly line.

UTILIZE BALL-AND-SOCKET FIXTURES

As already pointed out, three major assembly lines are in use. Each of these lines consists of a continuous conveyor threading the edge of a bench-height work table approximately 50 ft. long and 6 ft. wide. The ends of each table are rounded to facilitate conveyor travel. Ball-and-socket adjustable fixtures, which in turn mount special holding fixtures, are attached to the conveyor at 36-inch intervals. Thus from 35 to 40 engines may be mounted for assembly at one time at each table. Conveyor speed is regulated by a callout on the M-T-M work sheet which specifies the number of engines that must pass a given work station in an hour to maintain the 100 per cent production figure. Conveyor speed is increased as required when the line is working at a bonus rate.

All of the later engines, regardless of model have a cast-in-place external flange on the die cast cylinder-crankcase component. This flange is provided for the sole purpose of attaching the ball-and-socket mounted holding fixture during major assembly. Thus the same holding fixture can be used on all models except those designed and developed before the "holding flange idea" came into use. This greatly minimizes tooling changes required when switching from one model to another.

OVERHEAD CONVEYOR FEEDS THREE LINES

A single overhead conveyor crosses each of the three major assembly lines. The speed of this conveyor is such that there is always an open hook available when it becomes necessary to remove an assembled engine from any one of the major assembly lines. This conveyor carries the engines directly to an enclosed and ventilated area where each engine is fueled, then run 15 minutes to assure proper operation.

After the run-up, the remaining fuel is drained from the engines, and they are once again hung on an overhead conveyor. This conveyor first travels through a spray cleaning booth where both accumulated shop dirt and stains and smudges caused by run-up are thoroughly cleaned from all surfaces. Beyond the spray cleaning chamber, the engines pass through an overhead infra-red drying tunnel. The conveyor then dips down and passes a station where all areas not to be painted are masked. Beyond this station, the conveyor carries the engines through a large, water-wash paint booth where the basic engine color is applied by spray painting.

ADD NON-OPERATIVE PARTS AFTER RUN-UP

Beyond the paint booth, and after infra-red paint drying, the engines travel to the first of two finish assembly stations. In the first station, such items as plated handles and exhaust stacks, starting components, cover plates, etc., are added. These are all non-operative parts which were not needed during the initial run-up. By installing them after rather than before basic engine painting, much masking work is eliminated.

From the first finish assembly station, the engines travel through a second run-up booth where engines are selected at random from the line and thoroughly tested. Random testing provides ample evidence that all engines passing through this booth are in satisfactory operating condition.

At the second finish assembly station, decals, name plates, etc. are added. Other necessary data is applied by merely roll coating a contrasting paint color on cast-in raised letters on the various engine components. Since McCulloch die-casts all its own engine parts, this "raised letter" facility is designed into the original die. Thus, with a single swipe of a roller coater, information is supplied which otherwise would require a more costly name plate or decal.

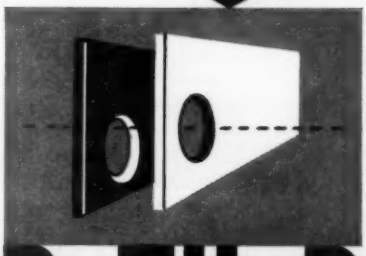
Final inspection takes place just beyond this final assembly station. The engines are then conveyed to the packaging and shipping area. But as each engine leaves this final area, it strikes a "banger" on the conveyor line which automatically records its passage in the plant superintendent's office.

USE CAREFULLY-ADJUSTED POWER TOOLS

Carefully adjusted power tools are used throughout engine assembly. Each of the major assembly work tables is provided with automatic screw drivers, torque wrenches, and impact tools. Critical nuts on stud bolts are tightened with an automatic torque wrench. Then they are checked with an accurately calibrated hand torque wrench to make sure that nut tightness is just as it should be.

Though seasonal sales variations cause some fluctuations in assembly requirements, the assembly department is entirely capable of assembling 1000 engines a day and maintaining this rate as long as required. •

DON'T LET THIS



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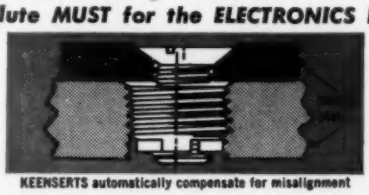

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Once selected, every adhesive must be properly applied and tested. Here's a practical how-to-do-it.

In applying adhesives, there must be a solid film between the two parts being bonded. A simple rule is to apply enough to each surface to fill all voids and have an additional film of such thickness as recommended for the particular adhesive used. A starting point would be to make this additional film .003″ thick.

Because, in most cases, a thin bond line produces a stronger joint than a thick one, the mating surfaces should be as parallel as possible

When bonding porous or semi-porous materials, a deeper penetration of the adhesive sometimes gives a better bond. This may be accomplished by priming these surfaces before applying the adhesive. Special primers are available.

Three factors are of major importance:

1. Proper surface preparation
2. Sufficient pressure
3. Sufficient temperature and time at temperature, if required

Clean surfaces are mandatory. Practically every adhesive requires some pressure for a 100% bond. Elevated temperatures for cure may or may not be required. For optimum

Flatwork segments placed between press platens are bonded under heat and pressure.

by **Edward V. Huda**
Project Supervisor
Adhesives Department
Raybestos-Manhattan, Inc.

results, metallic surfaces should be free of any rust, grease, previous platings, or like substances. Grease or oils, as an example, act as a parting agent. Any material used as a lubricant or mold-release agent will hinder bonding. When a part is bonded to a rusty or plated surface, the strength of the bond is only as good as the adhesion of the rust or plate to the metal.

An excellent and simple test for a clean surface is to pass a stream of cold water over the surface of a test sample. A chemically clean surface will hold a continuous film of water, and contaminated surface will hold the water in the form of droplets or puddles.

One of the simplest methods of preparing metal surfaces is vapor degreasing followed by shot blasting with a 40-60 mesh grit, sharp and clean. Vapor degreasing prevents any contamination of the shot or grit and consequent contamination of all future work.

This treatment gives an erose surface which improves shear or tensile strength. Where the parts are of such size that sandblasting will warp them, they may be chemically etched and cleaned. This process is more costly. Where chemical etching is necessary, procedures used by the plating industry may be selected for individual metals.

There are other techniques for removing rust and impurities from metallic surfaces. One is belt sanding. This technique has proven to be satisfactory for bonding brake linings to shoes. A common tendency is to obtain the least expensive belts available, which often leads to trouble since most belts are made with water soluble glues.

In general, however, sanding belts and discs are not recommended for preparing metallic surfaces for bonding. Belt sanding does not produce the effective erose surface obtained by chemical etching or shot blasting. Furthermore, the binder used on the belt can be transferred to the material. On hot and humid days, glues soften and can be transferred to metal surfaces. The surfaces may appear clean but will be coated with a loosely-adhering thermoplastic film that acts as a parting agent between the surface and the adhesive. If a sanding belt must be used, choose one with a thermosetting binder.

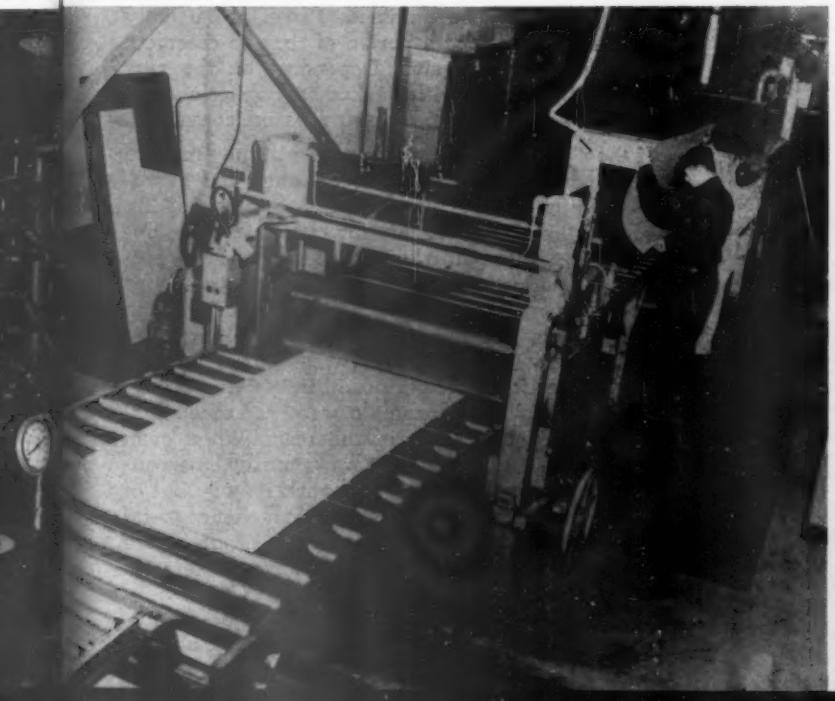
When metallic surfaces are prepared, in most cases they should be processed immediately to prevent recontamination. Some parts may be desiccated and stored for many hours; others may not. For example, aluminum parts should be processed within an hour.

For non-metallic surfaces, solvent washing is sufficient. As with metallic surfaces, all traces of dirt, oils, and other substances must be removed. Some surfaces, such as rubber, can be especially treated to give improved strength. Rubber, if cyclized (treated with concentrated sulphuric acid), will almost always exhibit improved strength properties.

In removing oils, vapor degreasing is usually considered first. Vapor degreasing (trichlorethylene or perchlorethylene type) is satisfactory only if the

continued

In this assembly line for desk tops, two steel skins are bonded to honeycomb core which is bonded in turn to a linoleum covering.



Tumbling machine shows brake shoes cleaned by air-blown metal shot.

solvent itself is clean. Quite often the grease content has been allowed to build up to a point where vapors will carry some of the grease up with them, leaving a thin film on the work.

The following recommendations are made for surface treatment of commonly-used metals:

Steel: Pickle in hot (160-180°F) 10% volume sulphuric acid or cold concentrated muriatic acid, and etch in cold 22% by volume nitric acid with water rinses between steps. Pickling removes scale; the nitric acid etches the surface. The time required for pickling depends upon the amount and nature of the scale. The time required for etching is that necessary to produce an erose condition over the entire surface of the work. After etching and rinsing, anodic cleaning is necessary for the removal of smut. Water-rinse and force-dry.

Aluminum: Dip parts in a hot (150-1700°F) solution of chromic acid for 5 to 10 minutes, water-rinse and force-dry. Solution is made as follows: 10 parts by weight of sodium dichromate; 50 parts by weight of 96% sulphuric acid; 340 parts by weight of distilled water. Dissolve the sodium dichromate in the water. Add the sulphuric acid gradually with constant agitation.

Copper and its alloys: Soak the work for 2 minutes in the following solution, water-rinse and force-dry: 1 part volume of 42% ferric chloride solution; 2 parts by volume of concentrated nitric acid; 13 parts by volume of water.

Pressure is required for every type of bonding application. Pressure sensitive adhesives and most epoxy adhesives require only sufficient pressure to keep the parts in contact. Some neoprene base types require much higher pressures but only for momentary periods. Others, such as the buna-N phenolic, heat-setting type, may require loadings from 50 psi to 1000 psi for the entire cure cycle, depending upon parallelism of parts being bonded.

To obtain the desired pressure, many techniques and types of equipment are used. Where only momentary pressure is necessary, two techniques may be employed: passing the parts through nip rolls or placing the parts between platens of a fast-acting press. Thermoplastic neoprene base adhesives, as an example can be bonded by either technique. These types are supplied as solvent systems and can be bonded by three methods: solvent evaporation, solvent reactivation, or heat reactivation. The adhesive is usually applied to both parts to be bonded where optimum results are desired. The adhesive is either dried to a point called "aggressive tack" or until almost dry before assembly; dried to complete dryness and dampened with a suitable solvent just prior to assembly; or dried to complete dryness and heated, using ovens or lamp, to a specific temperature (usually 180-220°F) and assembled hot. For these types of adhesives, the last technique gives the optimum strength results and eliminates the problem of trapped solvent.

STACK BONDING ADHESIVES

For adhesives that require very low pressures, stack bonding is usually employed. If the parts are flat, momentary hand pressure is sufficient.

The most troublesome problems involving pressure are with the heat-setting resin or rubber-resin type adhesives, such as phenolics or buna N-phenolics. These require higher pressure than most adhesives. The pressure must be continuous and constant throughout the cure cycle. There is a transition from a solid to a liquid to a solid of the adhesive in which by-products are formed during cure. Pressure is required to take up for volume loss, to level out high and low areas of the bond line, and to allow for thickness variations of one or both of the substrates.

Equipment to obtain pressure for assemblies made with this group of adhesives is hot presses or packs. Through the use of flat plates and springs, follow-up pressure may be obtained. Packs are usually placed in an oven for a period of time to complete the cure of the adhesive. Depending on the part configuration, packs with stacked assemblies may be made up and passed through ovens on conveyors.

If the size and shape of parts permit, they may be cured individually by setting up induction or resistance type heating fixtures. One common set-up uses resistance-type heaters for cure and air cylinders for pressure. Cure times are shortened, generally, with induction or resistance type heaters, as higher temperatures can be obtained at the bond line rather than by hot presses or oven. There is an additional step required, however, when curing at high temperatures for short periods of time. When working with phenolics, for example, water is formed during the reaction or cure of the resin. When oven curing or, in most cases, hot press curing, the condensation product (water) can work its way out of the bond line before the adhesive has a chance to set up. With rapid cures, the adhesive can set up before the water vapor has a chance to form blisters.

The usual technique is to install a breather in the cure cycle, a momentary release in pressure not to exceed two seconds. There is a specific time for this open period because slight variations in temperature rise will vary the point of the breather.

When discussing, planning or reading about temperature in relation to cure cycles of adhesives, think of the temperature stressed as bond line temperature. It is surprising how often the cause of defective assemblies is under-cured adhesive. One of the frequent mistakes is to set up a cure cycle in a batch oven with only a few of the assemblies to be bonded. After the cycle is recorded and production started, the oven is loaded with many times the number of assemblies. The cure time will be kept constant with no regard for the decrease in temperature rise of the parts because of the additional load in the oven. Cure cycles should be set for the maximum loading while considering extreme conditions, such as initial temperature of the parts.

Check the temperatures often with potentiometers or indicators such as Tempilsticks. For setting initial cure cycles, the best technique is to insert a thermocouple into the bond line of one of the parts to be bonded to record temperature. Guesswork concerning the relation between surface and bond line temperatures will lead to many problems. Regardless of the temperature required, whether it be at low range or at high range, it should be recorded at the bond line.

With the heat-reactive adhesives, it is necessary to apply heat and pressure simultaneously within the ranges for the particular one being used. During the heat-pressure cycle, the first thing that occurs is a viscosity change of the bonding agent. The viscosity at this point depends upon the bonding agent itself and upon the temperature and the rate of temperature rise. In general, it is best to select an adhesive which will become just fluid enough during the heat application to permit flow from high to low pressure areas or to those where surfaces may be out of contact. This allows the bonding material to cover the mating surfaces smoothly

In the transition to the cured stage, the adhesive first becomes gelatinous. At the finished stage, it may range from semi-hard (rubbery) to rigid, depending on the particular formula being used.

CURING AT ROOM TEMPERATURE

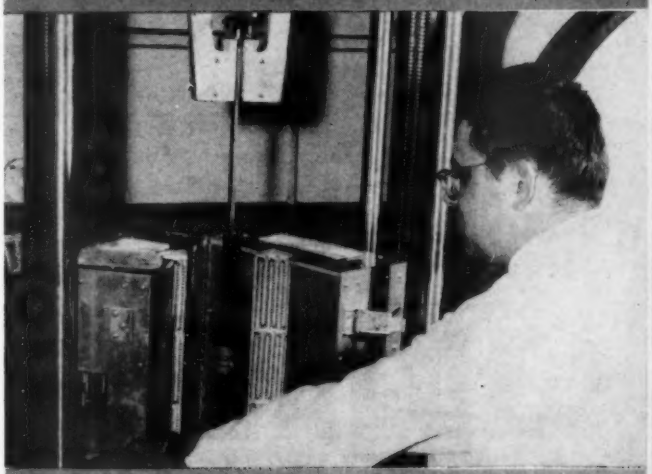
Adhesives which are cured at room temperature are usually supplied in two separate components. As soon as they are mixed, the cure starts. For this reason, the time during which such components can be worked is usually limited.

Other adhesives of pressure-sensitive type require no heat and negligible cure time. The parts are either assembled immediately after the application of the adhesive or given an open time to allow for the evaporation of the solvent before assembling.

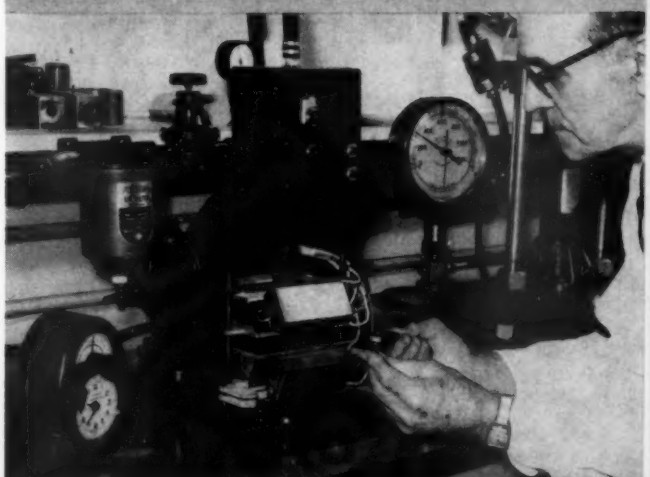
Testing is often desirable to evaluate the performance of an adhesive selected for a specific job. The feeling appears to be unanimous today to (a) select the adhesive and thoroughly evaluate it by

continued

Bonded lap joints are tested for 30 days (simulating 30 months) in a salt spray chamber.



The furnace is adjusted on a tensile testing machine. Adhesive is applied to metal plugs, heated and button tested for strength.



In evaluating the shear of thermosetting adhesives, two bonded metal discs are placed between heated platens and pressure applied for prescribed time.

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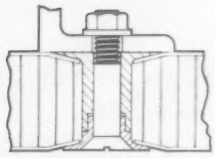

GROMMET FASTENER
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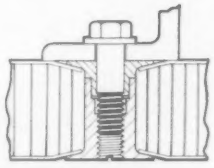
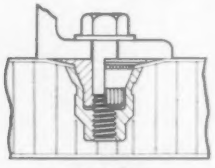
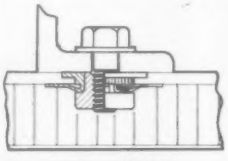


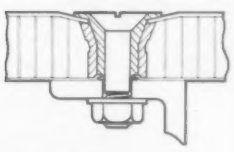
GROMMET FASTENER
Series 103
Series 104 (Self-Locking)



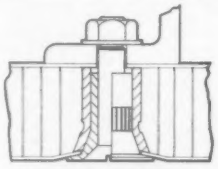
BLIND FASTENER
Series 293
Internal Thread Blind Type



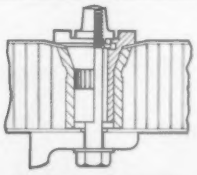
BLIND FASTENER
Series 293K
Threaded Clutch Type



STRUCTURAL FASTENER
Series 600 Flared
Thru-Rivet and Thru-Bolt Type



STRUCTURAL FASTENER
Series 600 Regular
Thru-Rivet and Thru-Bolt Type



STRUCTURAL FASTENER
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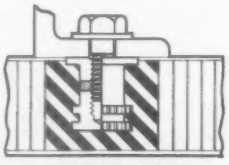
Floating Locknut Type



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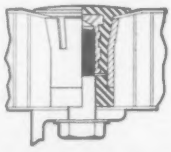

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bonding sample parts and subjecting the parts to an actual application under the most severe conditions that the part will meet; (b) set up a metal cleaning and bonding procedure that will enable parts to pass these tests; and (c) set up strict controls on all steps involved with the entire bonding technique, rather than relax in-process controls with the hope of catching defective parts at inspection.

With parts that can be tested, tests should correspond to the application. If a part is to be subjected to shear loads in the application, it should be tested in shear. Some tests, such as peel, are often performed in cases where the bond will never be subjected to peel loads and the adhesive may not need a high peel strength.

SHEAR TESTING FOR CLAMPED ASSEMBLIES

Shear testing is advisable on assemblies which permit clamping one member while pressure is applied to the other. Destructive shear tests, chisel tests, or bending tests are good for spot-checking.

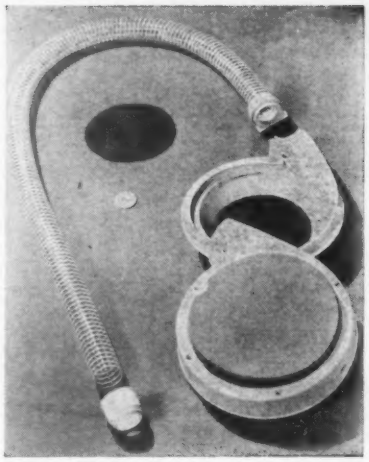
Overtesting is expensive and needless. Where it is impossible to set up a non-destructive test for every piece, samples should be tested.

When the failure occurs in bonding, the following tips may prove helpful in pinpointing the cause.

Examine the edges of the bond line visually. A slight crack between the members indicates lack of contact at the edges. Small beads of extruded adhesive should be visible on thermosetting types. Absence of this flash or extrusion indicates insufficient cement, incorrect heat or incorrect pressure. Presence of these beads, on the other hand, provided the heat and pressure are insured, indicates that the amount of adhesive applied is sufficient. The amount of cement should not be reduced in an effort to eliminate them.

The bonding of two surfaces that have a variation in thickness totaling .008" is not recommended. Such variations or low spots require applying a very thick film. Thick films generally give weaker bonds than uniformly thin films.

Our author, E. V. Huda, studies the result of a tensile test. A graduate of Pratt Institute of Technology, he is a member of ASTM's D-14 Committee on Adhesives.



Four rubber-base adhesives were used to bond these plastic components in the new G. E. hairdryer. The hose is polyvinyl chloride; hip pad, vinyl foam; case, acrylonitrile butadiene styrene copolymer; filter, polyethylene.

In applying the adhesive, the supplier's recommendations should be closely followed. If an adhesive manufacturer states that a .002″ dry film of adhesive is needed, he is usually referring to a .002″ film over the maximum thickness of the part. For example, if a part were 4″ square and had a variation in thickness of .005″ and this variation were in the center of the part, and a dry film thickness of .002″ were applied over the entire area, the low spot or center would have no bond. This is basic, but, again, often overlooked.

TROUBLE-SHOOTING FIELD FAILURES

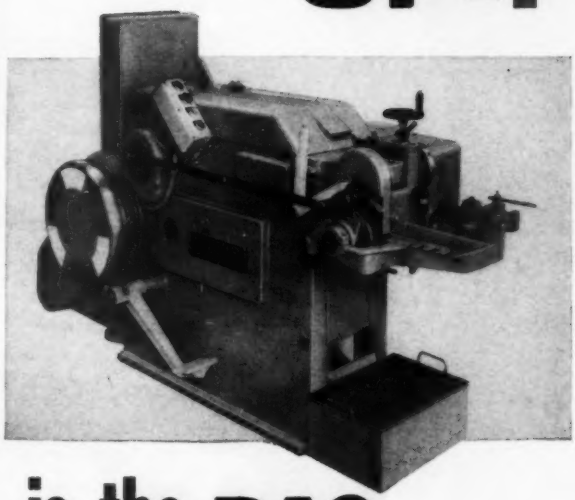
When field failures occur and are returned for observation, you want to know why. Regardless of the adhesive, if glossy areas are noted in the bond line of the delaminated assembly, the indication is poor contact. The solution to the problem is increased pressure or an increased amount of adhesive. Close observation and a little experience tells the observer which of the two it is. This condition may be noted with pack bonding when tolerances are such that binding occurs in the pack. When parts bind and are not allowed to contact mating parts properly, there is a deficiency in pressure that contributes to this condition.

With some adhesives, a cellular or porous condition will be noted. This also indicates lack of proper contact; again, no pressure or not enough adhesive.

With thermosetting adhesives, checks should be made for degree of cure of the adhesive. For most types this can be checked by wetting the surface of the adhesive with the solvent used in the manufacture of the adhesive. If the solvent softens the film or if there is a degree of tack present, indications are that the film is undercured. Again, this may not be true of the adhesive being used.

When field failures occur, the first reaction of an adhesive user is to blame the adhesive. When the final cause for the trouble is determined, it is almost always because of changes in in-process procedures. A complete review of the production line is recommended once defective bonds begin to appear. •

ROY
SP-1



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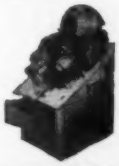

Another Famous Member of the ROY "Family" — Model C SCREW SLOTTER

If you can't come to Farmington for an actual demonstration, we will come to you in our Mobile Unit.

ROY MACHINERY & SALES, INC.

NEW BRITAIN AVE. • FARMINGTON, CONN.

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the new symbol of quality...

... with the background of time tested experience

For almost two decades we have been creating talented fasteners to solve the problems of modern industry. Allow us to present our new look. In the future you will find this attractive new symbol proudly identifying all GLS creative accomplishments in fastener design. Look for this symbol when you look for fasteners that do the most work with the least effort and least cost to you. Every GLS fastener is a jewel of perfection backed by experienced design engineers, master craftsmen and our new trademark - your *guarantee* of finest quality.

GSL

GREAT LAKES SCREW CORPORATION

EXECUTIVE OFFICES • CHICAGO 27, ILLINOIS

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In preparation for anchoring aluminum roofing, purlins with aluminum rivet strips are nailed to rafters.

Roof of all-aluminum prefabricated house is anchored with the aid of blind rivets

ALUMINUM RIBBED ROOF ANCHORED WITH RIVETS

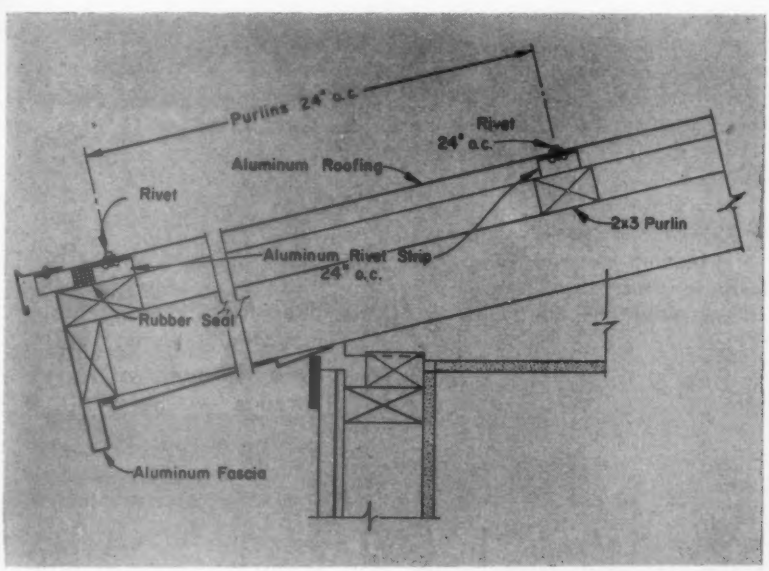
Architects and engineers at the National Homes Corporation, of Lafayette, Indiana, have been at the forefront in introducing mass production assembly techniques to the prefabricated homes industry. Some of their innovations in fastening and joining include bonding and riveting aluminum siding and anchoring ribbed aluminum roofs with blind rivets. The former is done in their factory*, while the latter is an on-the-site technique.

In selecting the roof fastening device, National Homes studied a number of considerations, including: installation from one side of the work; non-critical with regard to hole diameter, yet capable of producing a water-tight joint; sufficient tension and shear strength to resist wind and snow loads; and capable of joining two or three thicknesses of metal.

They decided upon a special blind rivet of the lock-spindle self-plugging type. Upon installation it provides a broad bearing area by spreading Daisy-type petals which prevent either workpiece tear-out or pull-through during assembly. While this rivet

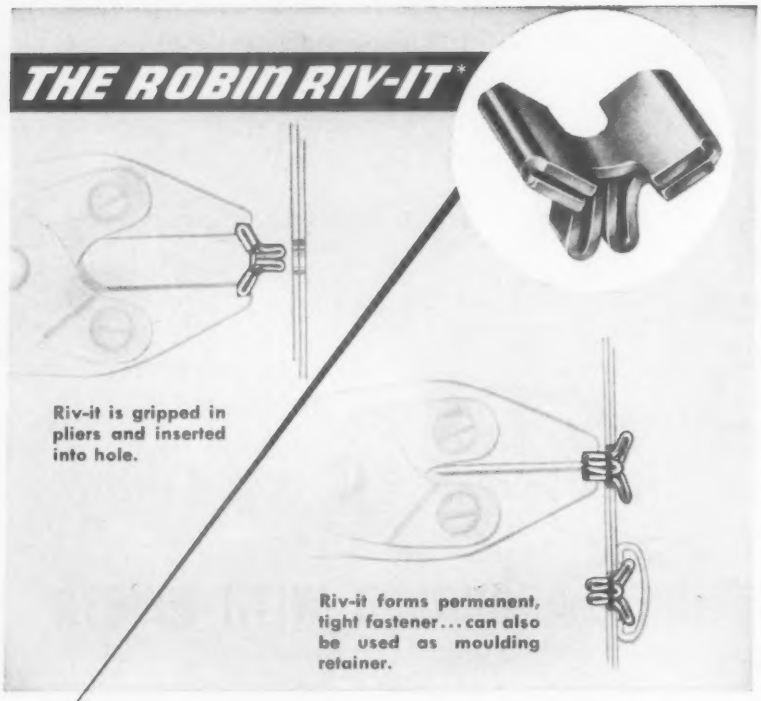
continued

*See "Bonding and Riveting Aluminum Siding", September 1959, Assembly & Fastener Engineering.



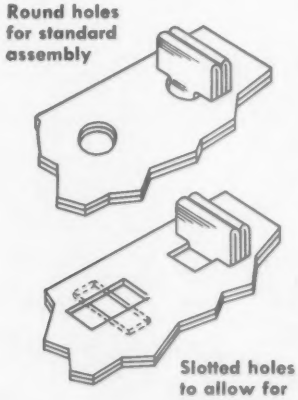
Drawing of eave section shows purlins installed on 24" centers. In fastening operation, as pin of blind rivet is pulled through, the rivet sleeve splits to form spreading Daisy petals which provide a broad bearing base.

Blind rivet with neoprene washer is installed with a turn of tool crank, including separation of pintail.


THE ROBIN RIV-IT*
Riv-it is gripped in pliers and inserted into hole.
Riv-it forms permanent, tight fastener... can also be used as moulding retainer.

ONE PIECE FASTENER
cuts cost... speeds assembly

HOLE LAYOUT



Cut cost of sheet metal parts assembly with the fast, vibration-free Robin RIV-IT. Based on a simple engineering principle, the RIV-IT requires only one hand to install and automatically draws up tight without the use of torquing tools. Because locking forces are at right angles to each other, a wide latitude of misalignment can easily be accommodated during assembly.

Robin RIV-ITS are stocked in a variety of sizes and materials or can be designed for your particular application. Hoppers and air guns available for high volume assembly. Write us today for complete details.

*Patented

ROBIN FASTNER

ROBIN PRODUCTS COMPANY
27027 Groesbeck Hwy.
Warren, Michigan

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is normally leak-proof when properly installed, added safety was provided by National Homes engineers through specification of a close-fitting neoprene washer.

Purlins with aluminum rivet strips attached are first nailed to the roof rafters on 24″ centers. Aluminum roofing sheets are then set in place, with the roofing sheet battens mating with the rivet strip battens.

A two-man team performs the drilling-riveting operation. One man drills holes through roofing battens on 24″ centers at each point where the roofing sheet contacts a rivet strip. A 9/32 drill bit is used. The second man follows with a Huck manual riveting tool.

The ¼″ rivet, equipped with a sealing neoprene washer, is placed in the nose of the tool. The rivet is then inserted into the hole through the mating battens. Installation is accomplished simply with a single rotation of the tool crank arm. •

REPRINTS AVAILABLE

- "Design and Application of Weld Fasteners" — July and August, 1959
- "Torque Considerations in Design"—January, 1960
- "Which Thread — Coarse or Fine?" — February, 1960
- "Designing for Silver Brazing with Preforms"—April, 1960
- "Resistance Welding Stainless Steel"—June, 1960
- "The Strength of Screw Threads"—June, 1960

If you need copies for your files, just drop us a note on your company letterhead.

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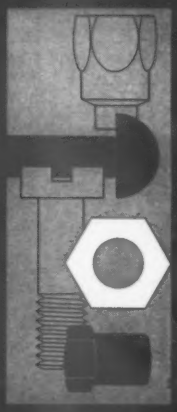
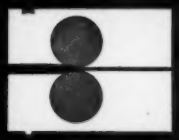


COLD HEADING MACHINERY

Cold Headers • Parts Formers • Nut Formers • Slotters • Threaders • Pointers • Trimmers and other Cold and Hot Forming Equipment

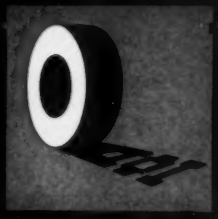


ROLLING MILL MACHINERY

Two-High and Four-High Mills • Special Mills • Sendzimir Mills • Rod Mills • Slitters • Coilers • Winders • Straighteners • Payoffs • Edgers • Coil Boxes • And Other Mill Equipment

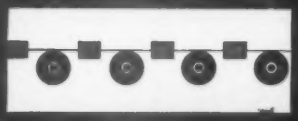
WATERBURY FARREL

MACHINERY BUILDERS



WIRE MILL EQUIPMENT

Continuous Tandem And Upright Cone Wire Drawing Machines • Bull Blocks • Wire Flattening Mills •



Swagers • Roll Pointing Machines • Spoolers • And Other Wire Equipment

POWER PRESSES

Cam and Crank Eyelet Machines • Horizontal Redraw Presses • Multiple Plunger Pillar Presses • High Speed Blanking Presses • Collapsible Tube Equipment • Ammunition Machinery, etc.

THE WATERBURY FARREL FOUNDRY & MACHINE CO.
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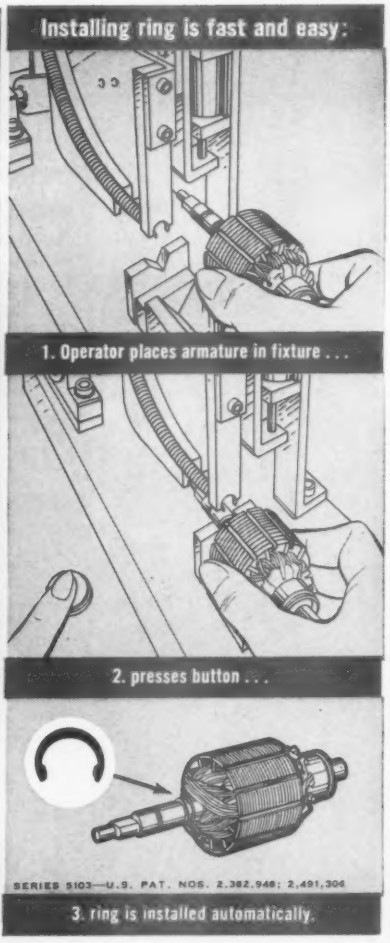
Installing ring is fast and easy:
1. Operator places armature in fixture . . .
2. presses button . . .
SERIES 5103—U.S. PAT. NOS. 2,382,948; 2,491,306
3. ring is installed automatically.

Mechanized Truarc ring installation speeds assembly

eliminates costly shimming and gauging operations

Fast, semi-automatic assembly and the elimination of costly production operations are among the benefits Leece-Neville Co., Cleveland, Ohio, derives from the use of Truarc retaining rings in the manufacture of its fractional horsepower automotive motors.

Radially-assembled Truarc Series 5103 Crescent® rings—supplied pre-stacked—are used to position and lock the armature in the motor housing. Using the special Truarc pneumatic applicator-dispenser illustrated above, the operator merely inserts the rotor and presses a release button. The ring is installed automatically in a pre-cut groove on the rotor shaft!

The precision manufactured Truarc rings, seated in accurately located grooves, reduce accumulated tolerances from a possible maximum of .184" to .025". Costly, time-consuming shimming operations previously necessary to take up end play are eliminated, together with as many as four gauging operations required to select and place the shims.

The Leece-Neville story is just one example of the way Truarc retaining rings are stepping up production on today's fast-moving assembly lines. These versatile fastening devices simplify design, speed assembly and eliminate rejects. In replacing conventional fasteners, they often improve product performance and reliability. All of these advantages are in addition to substantial cost savings!

Truarc retaining rings come in 50 functionally different types . . . up to 97 different sizes within a type . . . 6 metal specifications and 13 finishes. Special Truarc hand, magazine and automatic applicators and grooving tools make production-line application easy on virtually every type of product. Make sure you have on file the new 16-page Truarc assembly-tool catalog No. AT 10-58. Write for your copy today. And remember Waldes Truarc engineers are always ready to assist you with your special production problems. Write: Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, New York. 9.13

WALDES
TRUARC®
RETAINING RINGS
Waldes Kohinoor, Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS . . . THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

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Can't stretch your assembly area?
Then why not compress your individual work modules?

MODULAR BINS EASE ASSEMBLY SPACE PROBLEM

Before: former bench layout required 6 to 7 ft. of bench space per operator.

After: new compressed work module requires only 3 to 4 ft. per operator.

by **Vincent D. Lauria,** Manager
Industrial Engineering Department
and **Frank J. Bell,** Industrial Engineer
Allen B. DuMont Laboratories
Clifton, New Jersey

We recently undertook a program to further improve the manufacturing facilities of our Industrial Electronics Division. The over-all objectives were toward better house-keeping and work-place positions so as to provide more efficient parts handling and selection from a standpoint of motion and space economy.

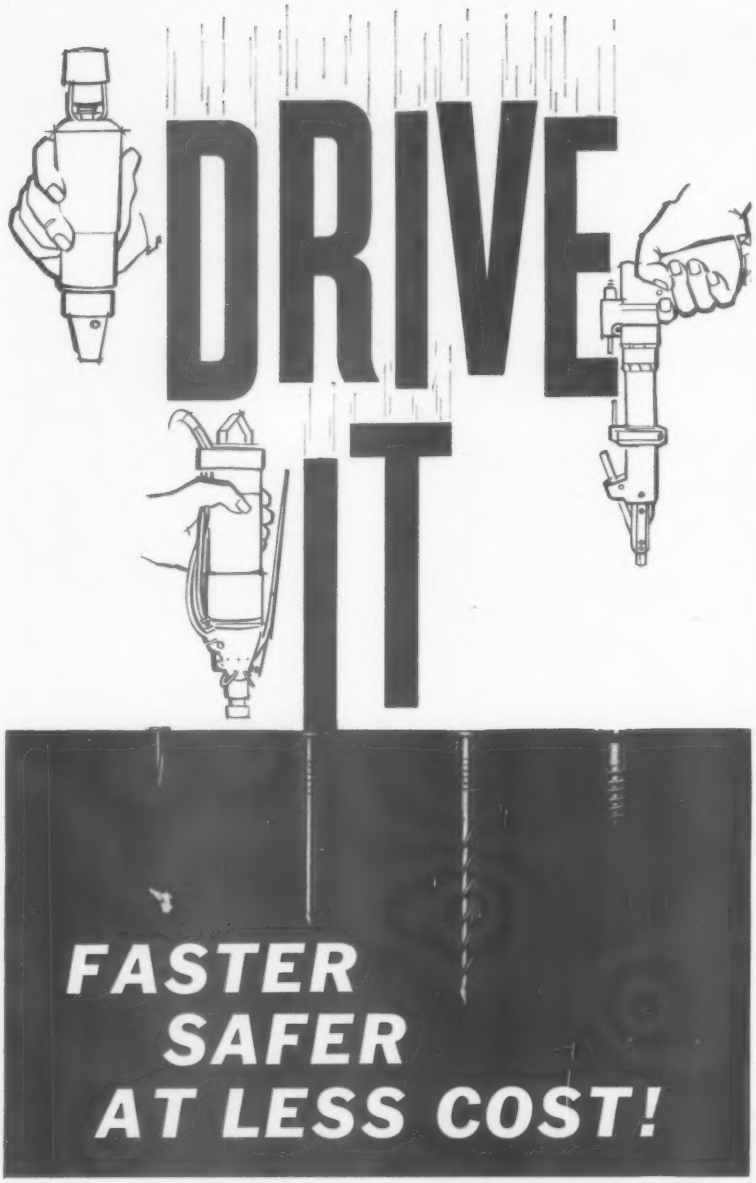
In the area of sub-assembly, the program provided for work handling fixtures, a Lazy Susan for switch and chassis assembly, plus wire cutting and color coding.

In the areas of mainline assembly and testing, the program provided for greater utilization of air-driving tools, aligning fixtures and modular set-up for test equipment.

With the aid of materials handling engineers from Gilbert-Tucker Associates, we developed and installed a modular material bin set-up in our sub-assembly area. This consists simply of the arrangement of two sizes of Bathey Flo-Bins on a bench-type rack mounted on a Lazy Susan capable of revolving a full 360°. The bins are arranged in the operational assembly sequence as prescribed by our department.

The completed work position includes a soldering iron, solder dispenser, tool holder, and a rubber mat placed before each operator.

continued



Now . . . a proven method just waiting to help you cut costs in fastening! If you use tacks, nails or screws, it's a good bet that POWASERT® automatic fastening can drive them faster, safer and at far less cost.

POWASERT equipment automatically feeds and drives — makes tacking, nailing or screwdriving an easy one-hand operation. Tacks at 300/minute, nails at 225/minute, screws at 60/minute, helps you boost production and improve product quality. POWASERT equipment is thoroughly engineered, foolproof, light and easy to handle. It is completely portable.

Send for the POWASERT Folder . . . The entire line of POWASERT automatic fastening equipment is described in an 8-page brochure. Please let us send you a copy. Your United Sales Engineer will be glad to demonstrate the equipment for you; or tell us your product and we'll send you facts and figures on similar applications. Call or write, today. United Shoe Machinery Corp., 140 Federal St., Boston, Mass.

United

POWASERT®

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A representative work station consists of approximately 60 parts bins ranging from small hardware components to larger pieces such as brackets, rods and chassis. This set-up can also accommodate 80 smaller sized bins.

The former bench layout required the use of 6 to 7 feet of bench space per operator. The modular set-up has permitted us to compress this to approximately 3 to 4 feet. As a result we have been able to almost double our production facility potential in the existing floor space. This savings alone has more than justified the expenditures incurred by this program.

PRODUCTIVITY UP 30 PERCENT

By providing the modular bin-set-up coupled with Lazy Susan type assembly fixtures, we were able to measure an increase of about 30% in productivity in several switch assembly operations.

In general we have found the modular set-up has the following savings and advantages: a 40 to 50 percent savings in floor space; visual control of the parts used; a reduction in reaching for the operator, resulting in greater productivity; improved housekeeping; and quick operational changes. •

"Your answer to 'What power tools have you operated?' . . . Electric razor isn't enough."

ELCO®

TYPE 1

THREAD-CUTTING SCREWS

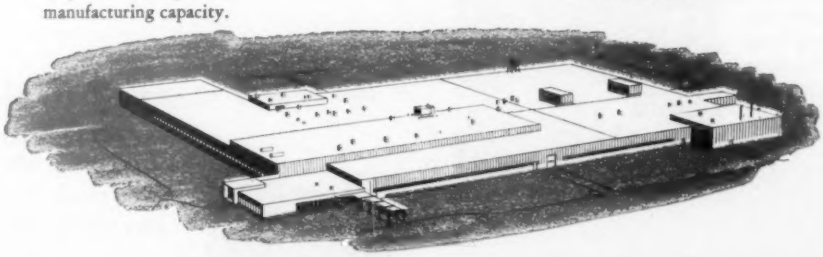
The use of Thread-Cutting Screws means lower costs on the assembly line. However, such savings may be lost unless the right type of screw is selected, and unless the buyer is assured that the screws he gets are of uniform hardness with correctly-shaped threads and sharp cutting edges. *For such assurance — buy from ELCO.*

TYPE 23

TYPE 25

NEW PLANT

You are cordially invited to visit us in our new factory — 242,000 sq. ft. of busy and well-organized manufacturing capacity.



ELCO TOOL AND SCREW CORPORATION

1101 SAMUELSON ROAD, ROCKFORD, ILLINOIS

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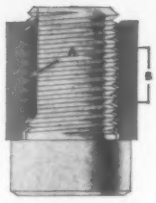
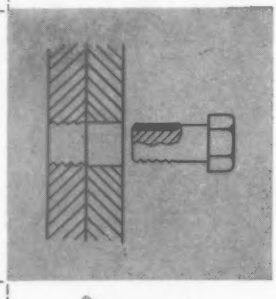
This is a LONG-LOK Self-Locking Screw. It is a one-piece reusable fastener, heat, vibration, impact and shock resistant.

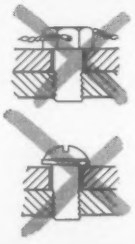
It is vibration resistant because the resilient, reformable insert (A) acts as a wedge between the male and female threads, causing a metal-to-metal drag (B).



LONG-LOK Self-Locking Screws are flush protruded and pass through normal clearance holes with finger pressure. No special clearance holes are required.



LONG-LOK Self-Locking Screws save time and money because they eliminate safety wire (and head drilling), and lock washers. They also save weight.



LONG-LOK Self-Locking Screws are available for aircraft, missile and commercial applications. They meet MIL-F-18240 Specifications and can be head marked for self-lock identification.

Write for Catalog LL-60

LONG-LOK CORPORATION

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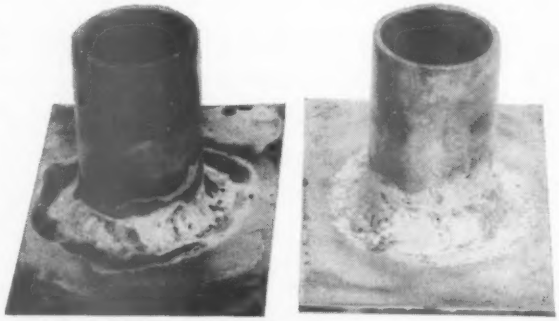
Lennox Industries Reports That . . .

LIQUID BRAZING FLUX AVOIDS DISCOLORATION

Discoloration produced on brazed copper and copper-base alloys has been eliminated by a liquid flux applied through a torch. Lennox Industries of Marshalltown, Iowa, found the system increased sales substantially on the company's coil and radiator line. Production time was also reduced, according to Donald Kenner, production manager.

The discoloration, produced by oxidation of the heated metal, is avoided by metering a liquid fluxing agent into the acetylene or propane welding gas. The Jet Flux forms a protective coating over heated metals, eliminates oxidation and lowers the amount of gas needed to produce high quality brazing.

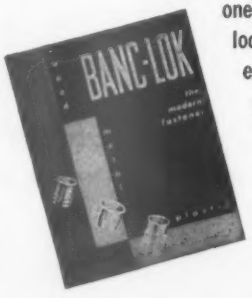
In operation, the flux is vaporized by a single automatic dispenser and introduced into the welding



Sample on the left was brazed with bronze rod using manually applied paste solder. Sample on right was brazed with bare bronze rod and liquid flux.

The Answer to your FASTENER problems

New Catalog on Banc-Lok, the versatile one piece insert which provides screw locking action. No special tools or extra locking devices needed.



Write:

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CORPORATION
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Victor 7-2727 TWX NWLK 95-U

BOOTS-WESTERN
432 North Lake Ave., Pasadena, Cal.
MU 1-6670 TWX PASA CAL 7255-U

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In welding the cooling coil unit, acetylene runs through dispenser (on shelf-upper right) where liquid flux is entrained and automatically fed through torch to work. Discoloration was eliminated.

gas line between the gas cylinder and torch. Welding gas flows through a metering tube and bubbles up through the liquid flux carrying the suspended flux to the flame.

As the chemical-laden gas burns, the flux-carrying liquid burns with a bright green color and deposits a protective coating wherever the flame touches the work. About two additional pounds of acetylene on the tank gauge are needed to push the gas through the liquid flux. This means no increase in acetylene use—only an increase in acetylene pressure.

The metered system does away with time-consuming paste fluxes. Metering regulates the flow of gas for more uniform consumption. The production cycle is shortened.

The flux gives excellent welding and brazing results with bronze, nickel-silver and copper alloys, cleaning as well as protecting. It is recommended for brazing carbon and low alloy steels, cast iron and brass and copper-base alloys. Any small residue left by the fluxing operation is soluble in water. Use of the flux is limited to alloys which flow at 1400°F or above. •

BOLTS 'N NUTS FROM REPUBLIC

"All is not lost, gentlemen! At least a half dozen 00x00 bolts are in orbit at this very moment!"

Adv. Republic Steel

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NOTHING KLINCHES LIKE *Klincher* LOCKNUTS

Isochromatic of photoelastic Klincher Locknut model and conventional nut under same load condition showing stresses set up in stud.

Scientific evaluation now proves what smart engineers have always known—nothing Klinches like *Klincher Locknuts.*

Recent photoelastic stress analysis conducted at the University of Minnesota proves that stresses in a *Klincher Locknut* were less than half as great as in a conventional nut under the same load conditions. The stress effect on the stud is one and one-half times greater with a conventional nut.

Thermal expansion up to 1600 degrees Fahrenheit and contraction is compensated for by *Klincher* spring action.

The *Klincher Locknut* locks after the proper torque is applied by compressing the threaded section inside the washer against the bolt, both radially and axially. The high load stress and torsional load are distributed evenly in the main body of the nut. More wrench torque can be applied before exceeding the elasticity in the bolt.

For high temperature fastening, particularly where road shock, high frequency vibration and tensile strength are factors . . . specify *Klincher Locknuts.*

More complete information on *Klincher Locknuts* is available. Write for data and samples, giving size and application.

KLINCHER LOCKNUT CORPORATION
2153 Hillside Avenue • Indianapolis 18, Indiana

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TRIMCLIP®

over forty years of industry leadership

Do you have a fastener problem? TRIM-CLIPS have been widely known and used in the automotive, radio, stove, refrigeration and aircraft industries most extensively for attaching trim panels and mouldings to the structure.

Find out for yourself the many applications of TRIMCLIPS . . . by presenting us with your problem. Send sample section, if possible, otherwise full description and details.

GAGNIER

FIBRE PRODUCTS COMPANY

10151 Capital, Oak Park, Michigan

Phone JOrdan 6-7366

Use postpaid card. Circle No. 247

AS SMITTY SEES IT

Got a question, challenge, puzzle to share or story to tell? Shoot it along, we'd like to meet you.

FUDGE FACTORS

In any assembly the fastener that most obviously has been properly tightened—beyond all need of checking—is the one to fail first.

Corollary 1—No one in quality control will catch it either.

Corollary 2—The first customer to examine the product will stumble across it immediately.

WHEN A SCREW IS NOT JUST A SCREW

Have you checked your revolver lately to see if it is held together properly? We read recently where one of the benefits of the self-locking screw is that "in field situations where dangerous game is encountered, the weapon's dependability is assured. The possible loss of important parts at a vital moment due to loose screws is no longer of concern."

DEFINITION

Educated Engineer—One who can describe an assembly problem without taking his hands out of his pockets.

NEW USES FOR WONDER METALS

Aluminum Ltd. reports that penal officials prefer aluminum coffee cups because they're "less effective as weapons in case of a prison riot." How these new markets are opening up for throwaways!

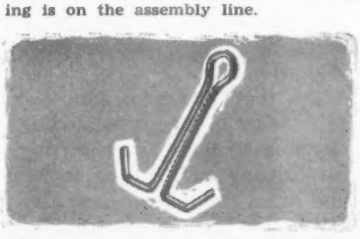
NEW PRODUCTS

Dumont Industrial Screw Corp., Los Angeles, is always trying to anticipate customer needs. Its New Products Department has become so proficient at this that occasionally a fastener is designed before the need is discovered.

This means that Dumont can offer fasteners its competitors would never think of making. Such is the case with the fastener introduced below, and others we will introduce in months to come. Before any were actually put on the market, competitors were asked not to copy any of the ideas, and they all agreed.

Pre-Bent Cotter Pins

Putting the proper twist on a cotter pin is a job that requires some skill, agility and, more important, time. Everyone knows now that 81% of the cost of fastening is on the assembly line.



These new pre-bent cotter pins can be installed by anyone, with or without skill and agility, in practically no time at all. This saves considerable time.

The pins are made only to order. To insure perfect fit, first install and bend a cotter pin on an actual production piece to the shape desired. Then send bent cotter pin as a guide. Remember, please send cotter pin only. Do not attach any work, etc. as this tends to confuse the production department.

MATH OVER LIGHTLY

To stimulate them in the study of partial differential equations, a professor of engineering offered to release his class 8 minutes early for every equation solved correctly. The penalty for each wrong answer was five minutes blackboard-time after class. At the end of 26 minutes, neither owed any time to the other. How many problems did the class solve correctly? (Answer on pg. 93)

—adapted from Clavius, 1608

"Many young engineers have become lost in bending problems when they were only trying to put two and two together."

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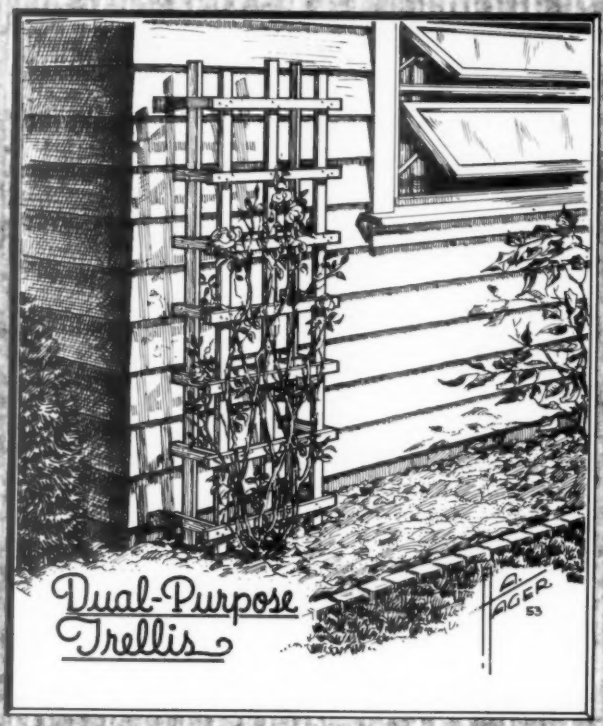
ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

Hobby-neering with "ROCKFORD" Screw Products

HOME WORKSHOP PROJECT of the MONTH



Hobby-neering with "ROCKFORD" Screw Products

ROCKFORD, ILLINOIS

ORIGINAL DESIGNS

SEPTEMBER 1960

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ROCKFORD

HOME WORKSHOP PROJECT of the MONTH

Hobby-neering with "ROCKFORD" Screw Products

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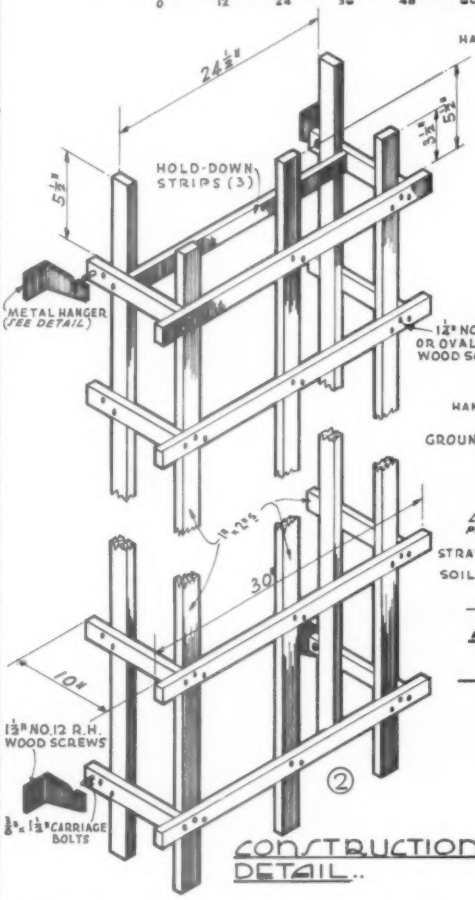
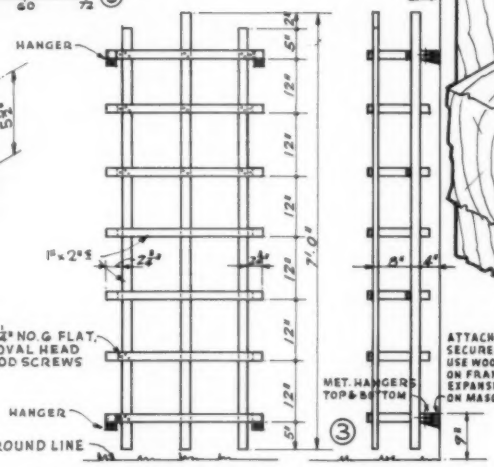
ROCKFORD SCREW PRODUCTS CO.
Rockford, Illinois

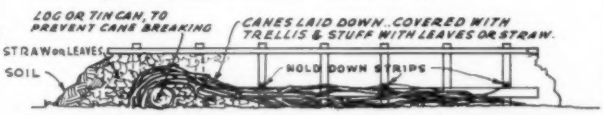
Dual Purpose Trellis



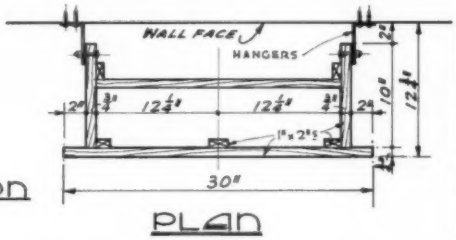
CONSTRUCTION DETAIL



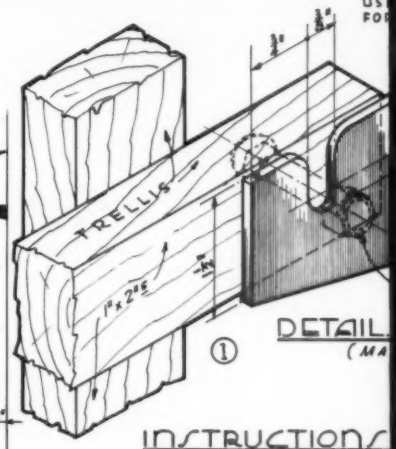
ELEVATION (AS SUMMER PILLAR TRELLIS) SECTION


LOG OR TIN CAN, TO PREVENT CANE BREAKING
CANES LAID DOWN, COVERED WITH TRELLIS & STUFF WITH LEAVES OR STRAW.
STRAW or LEAVES
SOIL
HOLD DOWN STRIPS

AS WINTER ROSE OR VINE PROTECTOR



PLAN



DETAIL (MA

INSTRUCTIONS

YEAR THAT THOUGHT B
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THOSE GORGEOUS CLIMB

- IT CAN BE AVOIDED, SA
THE BLOOMING SEASON, C
TIGHT AGAINST A WALL. H
TO CORRECT THESE PROB
THIS PROJECT THAT I HA
FICULTY. START MAKING
- IT IS AN ATTRACTIV
AS A STORM SASH, PROJE
SUN & AIR TO CIRCULATE
STRING OR TWIST-EMS FO
FREEZES, REMOVE CANES, L
SOIL, PLACE TRELLIS OVER
STUFF WITH LEAVES OR STR

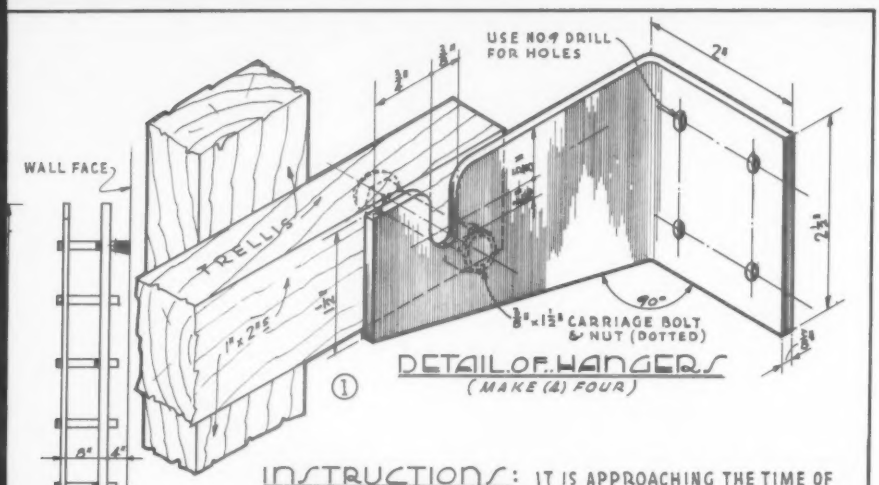
BILL OF MATERIALS

3 PCS	1" x 2" x 7'0"	
2 "	1" x 2" x 6'10"	
7 "	1" x 2" x 2'6"	
14 "	1" x 2" x 10"	
3 "	1" x 2" x 2'0½"	
(PINE, REDWOOD, RED CEDAR OR CYPRESS) STAIN OR PAINT		

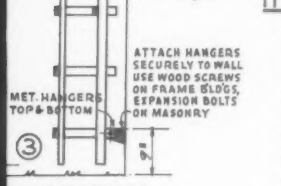
"ROCKFORD" WOOD SCR	
1 GROSS	1½" NO.6 OVAL H
8	1½" NO.12 RD.
4	⅜" x 1½" CARRI BOLTS
4	⅜" HEX. OR SQ. N
4	METAL BRACKET (AS DETAILED
SCREWS: BRASS, OR C PLATED STE	

7-7-53

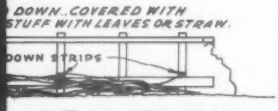
HAGER DESIGN STUDIO, ROCKFORD, ILLINOI



DETAIL OF HANGERS
(MAKE (4) FOUR)



SECTION
(TRELLIS)



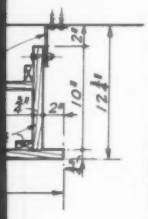
VINE PROTECTOR

INSTRUCTIONS: IT IS APPROACHING THE TIME OF YEAR THAT THOUGHT BE GIVEN & PREPARATIONS MADE FOR WINTER PROTECTION OF TENDER PLANTS & SHRUBS. WILL THOSE GORGEOUS CLIMBING ROSES BE WINTER KILLED?

- IT CAN BE AVOIDED, SAME AS THE UGLY MILDEW DURING THE BLOOMING SEASON, CAUSED BY NAILING SKIMPY TRELLISES TIGHT AGAINST A WALL. HAVE YOU WONDERED WHAT THE SOLUTION TO CORRECT THESE PROBLEMS MIGHT BE? WHY NOT FOLLOW THIS PROJECT THAT I HAVE DESIGNED TO OVERCOME YOUR DIFFICULTY. START MAKING AS MANY AS YOU NEED "NOW."
- IT IS AN ATTRACTIVE, RUGGED TRELLIS, HUNG AS EASILY AS A STORM SASH, PROJECTING 12" FROM THE WALL, TO ALLOW SUN & AIR TO CIRCULATE (NO MILDEW). TIE CANES WITH SOFT STRING OR TWIST-EMS" FOR EASY REMOVAL. BEFORE GROUND FREEZES, REMOVE CANES, LAY FLAT ON GROUND, COVER THEM WITH SOIL, PLACE TRELLIS OVER THEM AND AFTER GROUND IS FROZEN STUFF WITH LEAVES OR STRAW. REVERSE PROCESS IN SPRING.

Pretty Good Idea? HARRY.

Hobbyneering



BILL OF MATERIALS

3 PCS	1" x 2" x 7'-0"	"ROCKFORD" WOOD SCREWS	
2 "	1" x 2" x 6'-10"	1 GROSS	1½" NO. 6 OVAL HEAD
7 "	1" x 2" x 2'-6"	8	1½" NO. 12 RD. "
14 "	1" x 2" x 10"	4	⅜" x 1½" CARRIAGE BOLTS
3 "	1" x 2" x 2'-0½"	4	⅜" HEX. OR SQ. NUTS
(PINE, REDWOOD, RED CEDAR OR CYPRESS)		4	METAL BRACKETS (AS DETAILED)
STAIN OR PAINT		SCREWS: BRASS, OR CAD'M PLATED STEEL	

SERIES.. NO. 10

PROJECT 7

Designed by HAGER OF ROCKFORD

USE FOR COMMERCIAL PURPOSES IS STRICTLY FORBIDDEN

HAGER DESIGN STUDIO, ROCKFORD, ILLINOIS

7 Reasons Why Every Educator Needs the CUEMASTER

1 Allows inte
ing at any poin
of play from th

2 Allows bac
record playin
and without th
embarrassmen

3 Allows rep
part of the les
necessary for

4 Eliminate
modern record
manual handli

AND EVERYWHERE with "ROCKFORD" Screws and Bolts ★

❶ Allows interruption of record playing at any point, and then continuance of play from that point.

❷ Allows back-spacing or advancing record playing quickly, accurately, and without the usual trial and error embarrassment.

❸ Allows repetition of a particular part of the lesson as many times as necessary for the learning process.

❹ Eliminates the damage to the modern record that often accompanies manual handling of the pickup arm.

❺ Increases many fold the opportunities of teaching from a recording.

❻ Cuematic Scale Programming Charts allow coordinated advance preparation of recorded material.

❼ Saves valuable classroom time.

"CUEMASTER" by
RHEEM CALIFONE CORPORATION
1020 N. LaBrea Ave.
Hollywood, Calif.

SOCKET HEAD CAP and SOCKET SET SCREWS

- ENGINEERED and
- QUALITY PRODUCED
- FOR STRONGER
- ASSEMBLIES at
- LOWER COSTS

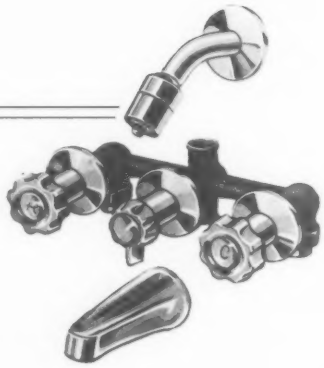
1960 Series
Head Marking Shown

"ROCKFORD"®
Screw Products Co.

ROCKFORD ILLINOIS

WRITE FOR CATALOG #102 and QUOTATIONS

Price Pfister BRASS MFG. CO.



CROWN IMPERIAL LINE
of bathroom fittings
and
CROWN JEWEL LINE
of faucets

Manufactured by:
PRICE PFISTER BRASS MFG. CO.
3011 Humbolt Street
LOS ANGELES 31, CALIF.

PROJECT OF THE MONTH

ROCKFORD

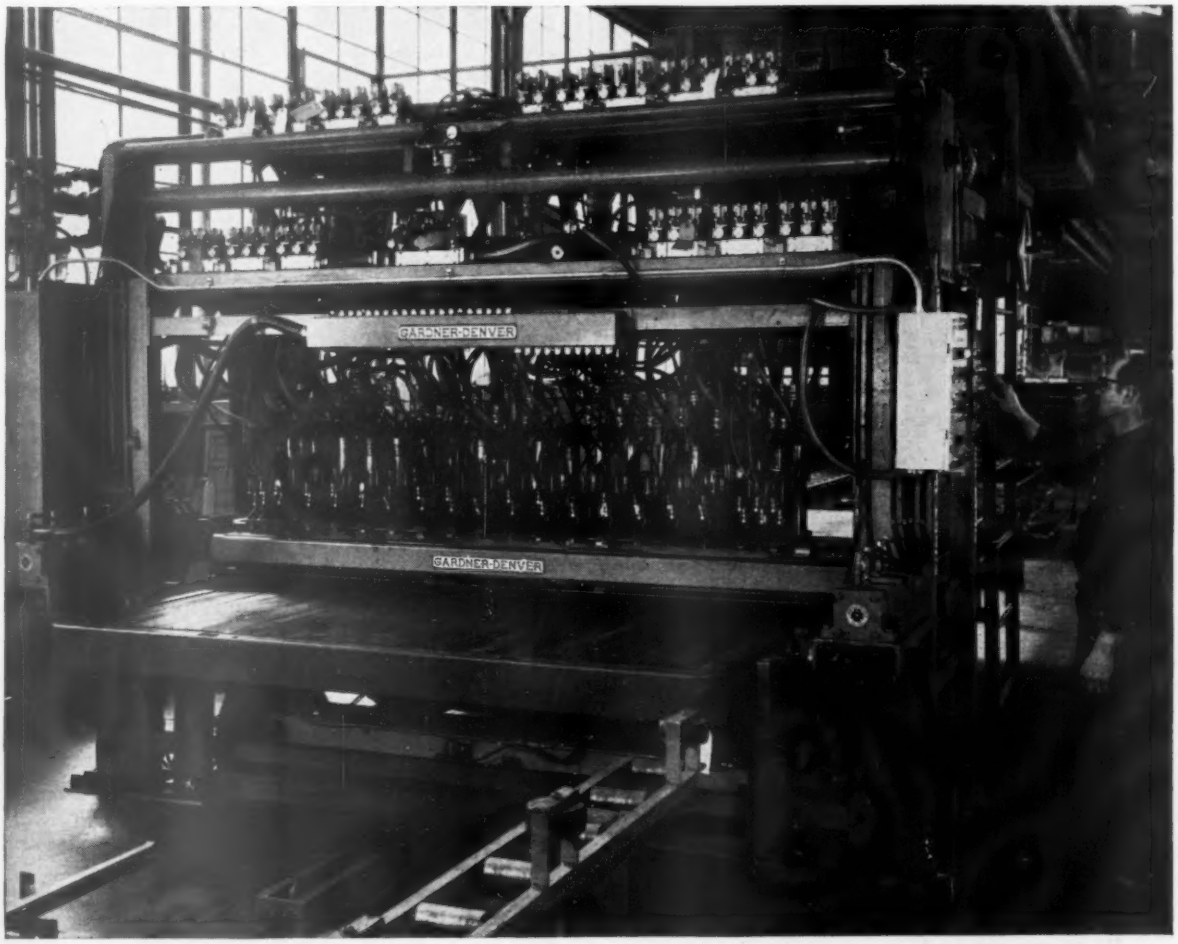
Rockford, Illinois

DRILL FEED DRIVE

with one automatic machine

Here's a push-button, air-powered machine specially designed and built by Gardner-Denver to drill holes, feed and drive screws automatically in a truck bed. Machine carries 20 Airfeedrills® and 20 screw drivers on a cross slide—enabling it to handle up to 40 holes in a row. Truck bed automatically positions itself for the next row of holes.

This is typical of how Gardner-Denver custom-designs production machines to automate any drilling or fastening job—saving time and money. For details, contact your Gardner-Denver air tool specialist or write for information.



Gardner-Denver production machine drills wood and metal truck body—sets ¼" x 2¼" self-tapping screws automatically at rate of 4560 per hour.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Use postpaid card. Circle No. 248

Spectacular new production tool for small assemblies

FOREDOM
miniature
power screwdriver
and NUT RUNNER

electrically driven
flexible shaft type
with exclusive
SCREW PICKUP / FINDER*
picks up screws
of any material!

*PATENT APPLIED FOR

Use this completely miniaturized power packed tool anywhere, in any position. It's a new concept for regular production or for special and delicate jobs inaccessible or awkward for other power drivers. In portable or hang-up models, it has adjustable touch control, weighs only 5½ oz., measures just 8" long. Available with a full range of quick changeover bits for screws and nuts from #0 to #4 — even larger in some cases.

If you're working on instruments and controls, aircraft, missiles, relays, switches or any of a host of other applications, this little powerhouse can probably mean substantial savings. Write for the name of our nearest distributor, and Bulletin No. 224-A-9

FOREDOM ELECTRIC COMPANY, INC.
BETHEL, CONNECTICUT.

Manufacturers of miniature flexible shaft power tools since 1922
Use postpaid card. Circle No. 249

GLOSSARY NEAR REALITY ON THREADED FASTENERS

A glossary of terms (nomenclature) for use by English speaking countries, with reference to screws, has been brought closer to reality. This is the result of decisions reached at the ABC (American, British, Canadian) Conference on Unification of Engineering Standards, held in Ottawa, Canada, June 6-11.

Intended to be an international standard recommendation, a preliminary glossary was submitted by the International Organization for Standardization. It was prepared in French and English by the ISO technical committee on bolts, nuts and accessories. The glossary will be studied further by representatives of the English speaking countries. When accord has been reached, it will be presented to the ISO for incorporation in a draft recommendation.

It was also decided that the proposal for gauging of screw threads, which the United States intends to present to the ISO as a draft recommendation, be first circulated to the British and Canadian standards organizations. It was felt that a review by these bodies could result in refinements and changes that would reflect the broad thinking of the ABC nations.

The Canadians and Americans agreed to study a British proposal in reference to slotted and castle nuts. The proposal deals with maintaining the dimensions from the bearing surface of the nut to the bottom of the slot at 2/3 the nominal head height of the finished hex nut. The resulting depth of slot would be standard for all nuts of the slotted and castle series.

Two questions of screw thread designations were referred by delegates to their respective standards bodies for further study. One involved a request by the British that the designation UNS be used only to denote diameter-pitch combinations. (This designation is used by American engineers to denote both special diameter-pitch combinations and threads of long engagement.) The United States delegation suggested the possibility that UNL could be used to designate special threads for long engagement. It was agreed that Sectional Committee B1 of ASA would take this under consideration.

It was also decided that the British and American standards bodies would consider a separate designation for a special aircraft thread with a rounded root. The letter J had been proposed for this purpose in the United States, thus UNJC for coarse and UNJF for fine thread.

The conference was attended by 75 senior engineering executives. The American delegation was headed by Roy Trowbridge, of General Motors. Sir Anthony Bowlby, of Guest, Keen & Nettlefords, led the British delegation, and J. W. Morrow past president of the American Iron & Steel Institute, led the Canadian delegation. •

FOR SEMS...BUY P-K®

Dome Plain Periphery Washer SEMS
External Tooth Washer SEMS
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All Types of SEMS and Pre-assembled Fastener-Washer Combinations

Whatever you require in pre-assembled washers... SEMS, and neoprene or nylon washer STAPS®... in thread-forming and thread-cutting tapping screws, or machine screws... with slotted, Phillips or Hex heads . . . P-K can supply them all through your local P-K Distributor.

P-K SEMS reach your assembly line pre-assembled, ready for instant use. Washers cannot come off—can never be mislaid or misplaced—insures washers on screws...not on the floor! Double inventory and double parts handling is completely eliminated.

P-K SEMS can be hopper fed for automatic driving. Inspection rejects due to omitted lock washers are impossible—fastenings stay tight and firm. P-K Sems assure concentric washer seating.

STAPS® are standard P-K fasteners, pre-assembled with nylon or neoprene washers for effective control of leaks, squeaks, crazing and electrolysis, in all types of metal structures and assemblies.

Your nearby P-K Distributor can meet your needs. Call him for samples and complete information.

PARKER-KALON® fasteners

Keep American Industry at Work . . . Buy P-K . . . made in U.S.A.

PARKER-KALON, a division of General American Transportation Corporation, Clifton, New Jersey. Offices and warehouses in Chicago and Los Angeles.

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Tighter Wrenching...Faster Assembly
Up to 20% Purchase Cost Savings

Every time you use Countr-bor Screws you improve your products *and* save both time and money. Made of high-strength alloy steel, Countr-bor Screws fit in standard counterbored holes . . . tighten with standard socket wrenches . . . cost up to 20% less than regular socket head cap screws.

Countr-bor Screws wrench down faster *and* tighter because they have 12 external gripping points . . . 3 times the gripping surface of internally wrenched socket head screws. Without the usual gaping hole of socket heads, Countr-bor Screws look better, too. Countr-bor Screws can also save you money for flat surface applications where clearances are tight.

Countr-bor Screws are available in sizes from ¼" through 1". Special sizes, threads and materials are available on order.

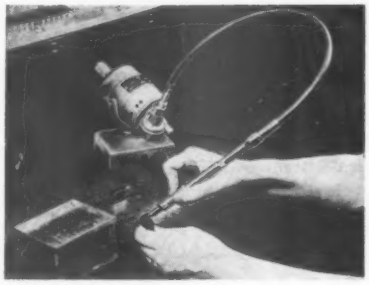
Start saving now . . . send for free test samples of any desired size.

Ferry Cap & Set Screw Company
2151 Scranton Road, Cleveland 13, Ohio

Use postpaid card. Circle No. 251

WHAT'S NEW IN EQUIPMENT

For information on any equipment listed here, use the postpaid card opposite page 82. Just circle the number on the card matching the number following the description. We'll do the rest.



(See 1)

MINIATURE, ELECTRIC POWER ASSEMBLY TOOL

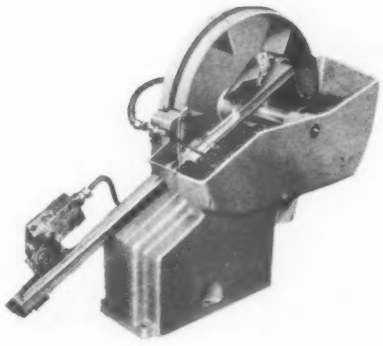
An electric, flexible shaft screwdriver, which doubles as a nut runner, is completely miniaturized. The 5½ oz. power tool drives screws and nuts from No. 0 to No. 4.

Available in bench and hang-up models, the unit has a pickup-finder which permits quick pickup of ferrous or non-ferrous screws.

Bits can be changed without use of tools, wrenches or keys. A special snap-lock holds them in place. The unit is supplied with an 8" long handpiece and 24" flexible shaft. Driving torque is 28-32 in.-oz., normal with 5 in.-lbs. maximum.

Foredom Electric Co., Inc., Bethel, Connecticut.

Use postpaid card. Circle No. 1



(See 2)

STANDARD FEEDER HANDLES 200 PARTS PER MINUTE

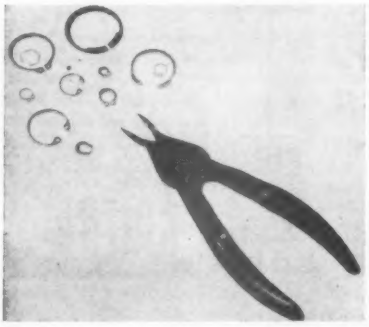
A standard parts feeder capable of handlling up to 200 parts per minute can be set up to operate with Dixon screwdrivers, positioners or other types of assembly equipment.

Model FE-103 has drum cleats for delivering the parts to the track which is fabricated from spring steel and molded rubber. This provides positive, but gentle, action which prevents damage to piece parts.

The pictured feeder is equipped with a solenoid-operated escapement, but the feeder can be operated with the ram-type or other models. The bowl has a capacity of 700 cu. in. and parts up to 1½" in diameter or 3" in length can be handled.

Dixon Automatic Tool, Inc., 2300 23rd Ave., Rockford, Ill.

Use postpaid card. Circle No. 2



(See 3)

PLIERS HANDLE INTERNAL, EXTERNAL RETAINING RINGS

Convertible field pliers for both external and internal retaining rings do the job formerly handled by five pliers.

Truarc No. 12 is designed for limited production application or maintenance. It compresses internal type rings for insertion into a bore or housing and expands external rings for assembly over a shaft.

In operation, a simple adjustment of the pivot pin on which the two halves of the pliers turn permits the tool to be set so that the tips come together or spread apart when the handles are compressed.

Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N.Y.

Use postpaid card. Circle No. 3

AIR DRYING, SOLID FILM LUBRICANT FOR ASSEMBLY

Surf-Kote A-1290 is a new type of air drying, solid film lubricant containing molybdenum disulfide.

The lubricant, applied by spraying, dipping or brushing, is used extensively for lubricating surfaces inaccessible after assembly. It has found application as a protective coating and after drying is not affected by humidity or unusual atmospheres.

Hohman Plating & Mfg., Inc., 814 Vermont Ave., Dayton 4, Ohio.

Use postpaid card. Circle No. 4

MECHANICAL FEED DRILL PRODUCES CLEAN HOLES

Mechanical feed drills produce holes which seldom require reaming, even in tough materials. There is no plunging on break-through, and constant feed decreases the amount of burr at the hole rim. Even when drilling at difficult angles, holes can be precisely located and misalignment problems are therefore eliminated.

The unit consists of a Multi-Vane air motor powering the positive feed mechanism. The twist drill is automatically fed into the material being drilled at a predetermined rate until a pre-set depth is reached. Twist drill cannot wobble or run out in tough materials. Five rates of feed are obtainable. Changeover from one feed rate to another can be done in the toolroom by a minor gear change.

The drills are available in 12 speeds from 450 to 4500 rpm, two power ranges,

INDUSTRIAL
RETAINING RINGS
cut costs,
simplify assembly

Precision-engineered INDUSTRIAL Retaining Rings . . . internal, external and open types . . . are available in a wide selection of sizes and finishes. Solve your fastening problems simply and economically with the rings that cut machining and tooling expense, save material, simplify and speed assembly.

Series 1000 and 2000 are available *stacked* for quickest application.

Write for free ring samples and catalog.

IRR *Originators of modern retaining ring dispensing*

INDUSTRIAL RETAINING RING COMPANY
Dept. A-9; 57 Cordier Street
Irvington 11, New Jersey
Use postpaid card. Circle No. 252

straight or offset handles, and 0 to 5/16" drill chuck capacity. Forward travel and quick-return adjust from 0 to 1¼". Feed is engaged by a jaw-type clutch.

Ingersoll-Rand Company, 11 Broadway, New York 4, N.Y.

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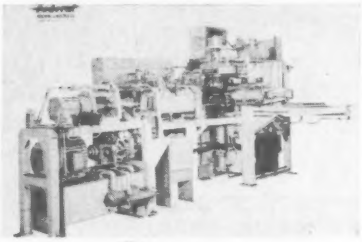
AUTOMATIC SEAM WELDER PRODUCES MOTOR SHELLS



A travelling head seam welder with automatic feeding, transfer and expanding units produces motor shells from flat sheets at a rate of over 500 shells per hour.

Power is derived from a 400 kva transformer. The weld head seam unit is operated by an 8" diameter air cylinder providing 4000 lbs. of weld force at 80 psi. Weld speed is 15-20 ft. per minute based on continuous timing.

The Federal Machine & Welder Co., Warren, Ohio.

Use postpaid card. Circle No. 6

AIR HAMMER FOR RIVETING, HEAVY DUTY APPLICATIONS

Short barrelled, heavy duty Model SP-400 air hammer has a beehive spring retainer so that the cutting tool can rotate. The unit is useful for rivet busting, riveting and panel cutting.

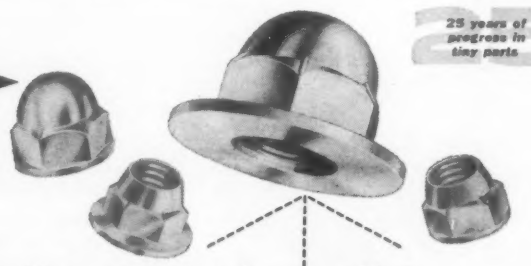
The hammer has a metering trigger that controls blows from 0 to 3500 per minute. Over 20 tools can be attached to the unit.

Superior Pneumatic & Mfg., Inc., 13800 Enterprise Ave., Cleveland 35, Ohio.

Use postpaid card. Circle No. 7

another new exclusive
GRC idea

25 years of progress in tiny parts



GRC die cast zinc alloy
washer-base
CAP NUTS

GRC makes new exclusive low cost fasteners with integral Washer Bases for better fastening performance and appearance. Won't mar soft surfaces. Use with oversize or offset holes. Prevents wrench marks. All these advantages at no extra cost to you. Use standard diameter nuts wherever regular cap nuts would be used alone—full diameter nuts wherever regular cap nuts would be used with separate washers.

standard washer diameter

full washer diameter

Both closed end and open end washer base cap nuts available with full and standard washer diameters. In addition GRC has the most complete stock of Standard CAP NUTS.

Standard thread sizes from No. 4 through ⅜"—14 hex sizes.
- **Rustproof and corrosion resistant**
- **No tool marks or cut off burrs**
- **Save assembly time—inventory costs**

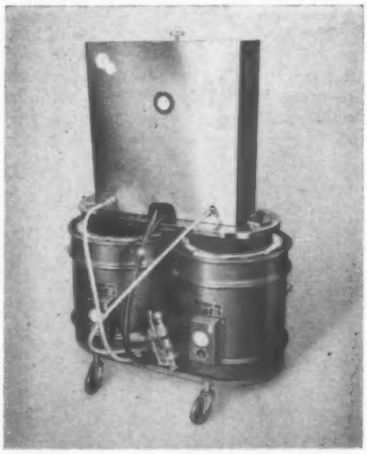
Cap Nuts and Wing Nuts in a wide range of styles and sizes. Write today for samples, prices and new detailed catalog.

GRIES REPRODUCER CORP.
World's Foremost Producer of Small Die Castings
15 Second St., New Rochelle, N.Y. • NEw Rochelle 3-8600

GRIES

Use postpaid card. Circle No. 253

EQUIPMENT PUMPS, METERS APPLIES 2-PART ADHESIVES



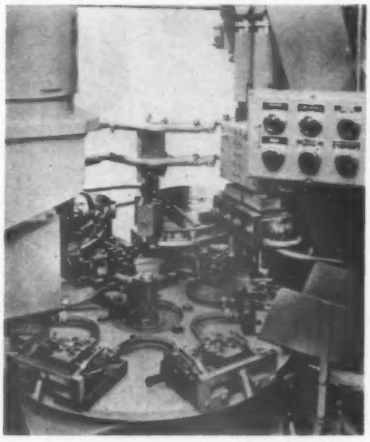
Continuous pumping, metering and applying of flowable two-part adhesive compounds is provided through Duo-Flo equipment.

The portable machinery meters compounds 0 to 20,000 CPS viscosity, five parts per hundreds to 50-50 epoxies, polyurethanes, polyesters, and foam. The Duo-Mix gun has an adjustable spray range and adaptability to 55 gal. drums.

Pyles Industries, Inc., 20855 Telegraph Rd., Detroit 41, Mich.

Use postpaid card. Circle No. 8

DUAL HEAD, DIAL FEED WELDING MACHINES

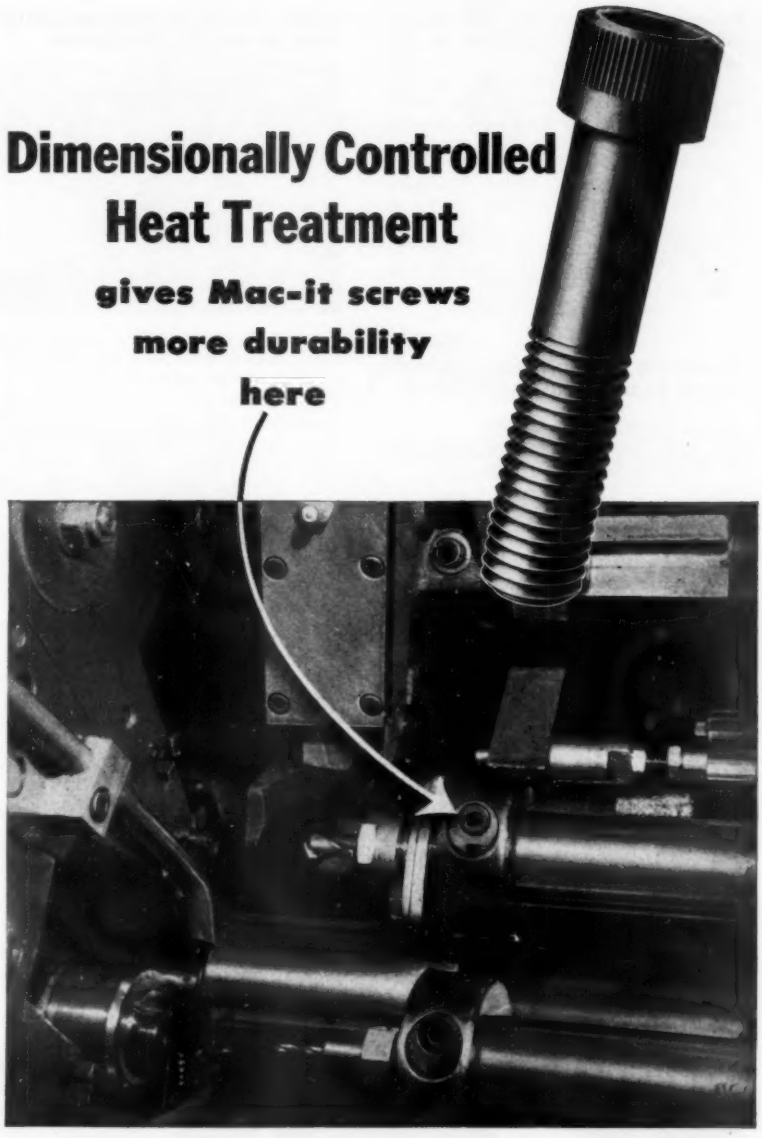


A line of dual head AVB-3 dial feed bench welding machines is designed for mass production welding of small parts. These machines are particularly suited to the assembly of electrical components.

The pictured setup shows the six-station Geneva dial feed table tooled for welding spring contacts to two different styles of yokes for electrical outlets, one of which requires a forming operation (forming head is at left). The springs are series welded to the yokes by dual, adjustable, air-operated welding heads, mechanically interlocked and

Dimensionally Controlled Heat Treatment

gives Mac-it screws more durability here



The heat treatment specifications for every Mac-it alloy steel screw are determined by its dimensions as well as its intended use.

At Mac-it, large and small diameters are not run through the heat treating processes indiscriminately. Instead, our metallurgists establish a heat treating cycle for each type and size. This assures that every screw has the proper combination of strength, toughness, ductility and resistance to vibration and shock.

Dimensionally controlled heat treatment is just one illustration of the care which is taken in every step in the manufacture of Mac-it screws. That's why Mac-its *hold tight in a tight place.*

Buy by name from your distributor—buy Mac-it

Mac-it®

MAC-IT PARTS COMPANY
DEPT. 20, LANCASTER, PA.

MAC-IT ALLOY STEEL SCREWS

Use postpaid card. Circle No. 234

balanced. Parts are fed and ejected automatically. Production rate is 1500 to 1700 parts per hour.

The same basic machines can be equipped with tooling to satisfy forming, assembling, and fastening requirements of a variety of parts in many industries. The model pictured has a 30 kva transformer. Other standard models are available from 10 to 50 kva.

Precision Welder and Flexopress Corp., 3520 Ibsen Ave., Cincinnati 9, Ohio.

Use postpaid card. Circle No. 9

TAPPING, THREADING TOOLS WITH FLOATING SPINDLE

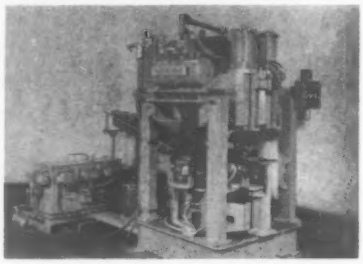
A line of compact tapping and threading tools eliminate the need for lead screws or sensitive hydraulic and mechanical feeds on automatic screw machines, multiple spindle drilling machines and turret lathes.

The tools have wide capacity ranges and relatively small diameters. Rubberflex collets permit the wide tap capacity. Tools also have axial floating drive spindles and positive depth control.

Tapmatic Corp., 645 W. 16th St., Costa Mesa, Calif.

Use postpaid card. Circle No. 10

STUD-WELDER USES MACHINE SCREW PARTS AS STUDS



A special automatic stud-welding machine cuts costs by using simple machine screw products as studs.

Used primarily in the refrigerator compressor industry to date, the unit can handle 200 housings per hour. The four-station index machine consists of work loading, idle, welding and ejection stations.

Progressive Welder and Machine Co., 915 Oakland Ave., Pontiac, Mich.

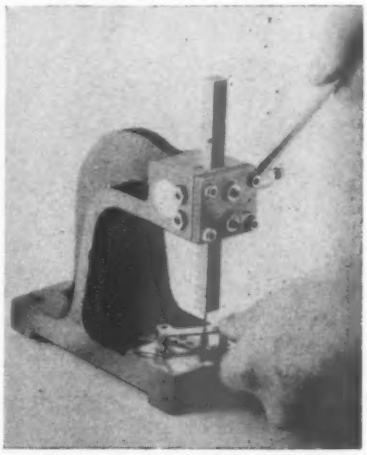
Use postpaid card. Circle No. 11

MINIATURE ARBOR PRESS FOR ELECTRONIC ASSEMBLY

The accuracy and smooth, uniform action required for assembly of instruments, miniaturized parts and electronic components are provided by a miniature arbor press.

The Micro-Press M-100 is equipped with adjustable front and side gibs to assure alignment and accurate application of force throughout the 2½" stroke of the ram.

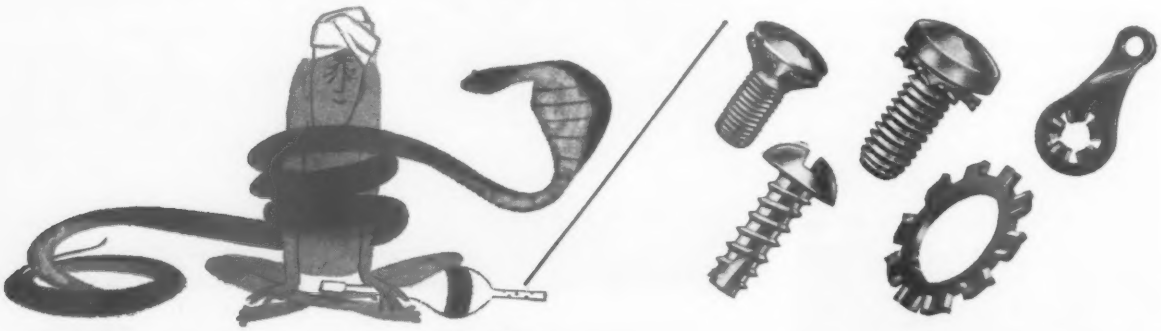
The M-100, rated for a working force of 2/5 ton, can be equipped with tooling for shearing and cutting, dimpling, piercing, broaching, riveting, blanking, light upsetting, drawing, forming, friction pressing, positioning of miniature



ball bearings and bushings and setting of jewels and dial pointers. For precision depth control, it can be fitted with a dial indicator.

Dickenson & Associates, 940 Alma St., Glendale 2, Calif.

Use postpaid card. Circle No. 12



Togetherness

matters with industrial fasteners, too!

Togetherness, industrial style, has a special meaning at Thompson-Bremer because we are one of the few fully integrated manufacturers of Sems, lock washers, thread-cutting screws, terminals and cold-headed specialties. With our engineering services and components manufacturing together under one roof, we can give you faster, more individualized service at competitive prices. We'll bid on your specials requirements, or fill orders for standard items on short notice from the extensive line of EVERLOCK products stocked by your local distributor.

If you buy or specify industrial fasteners, you want whatever your company assembles to go together economically and stay together reliably. Send for catalog and samples or call your EVERLOCK representative.

AMF Everlock INDUSTRIAL FASTENERS

Thompson-Bremer & Co. Division of American Machine & Foundry Company

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228 N. LaSalle St., Chicago 1, Ill.
Please send me:
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Company_____
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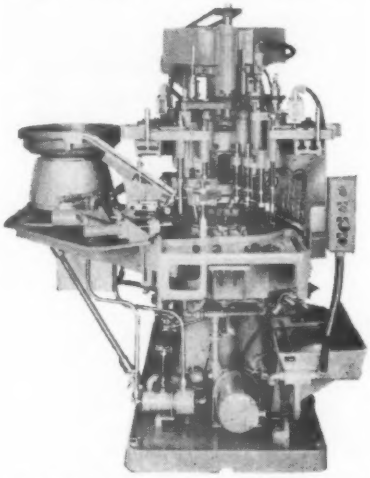
BUILD SPECIAL ASSEMBLY MACHINE FROM STD. PARTS



Model 41-20, a special assembly machine built from a standard chassis, will be exhibited at the Machine Tool Exposition—1960. The unit produces squeeze type B-X connectors.

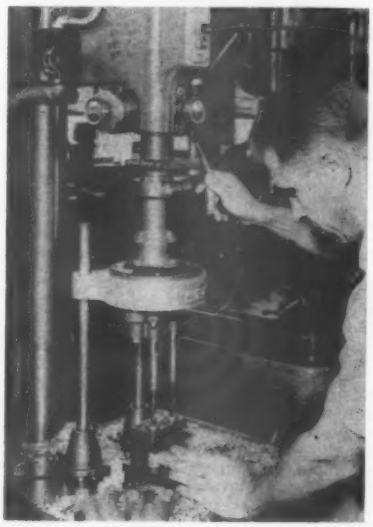
Engineering consisted of space layouts and design of fixture equipment. The base, spindle equipment, screw feeding unit, air cylinder units are off-the-shelf items.

The machine, running at 25 strokes per minute, performs 8750 operations per 50 minute hour, completing 1250 pieces. The same machine with different dial equipment and realignment of spindle equipment can produce many similar parts.

The Bodine Corp., 317 Mountain Grove St., Bridgeport 5, Conn.

Use postpaid card. Circle No. 13

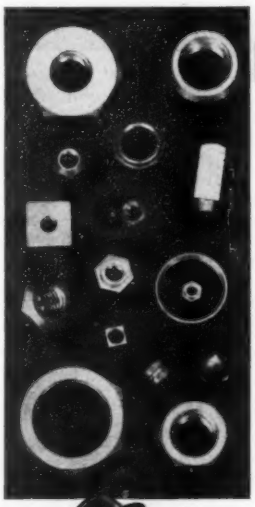
DRILL ADAPTABLE TO VARIETY OF POWER SOURCES



Model A, a multi-angle drill unit, may be adapted to a variety of power sources. The self-actuating unit's built-in feed and return air cylinder has a 4" power stroke. Any stroke length to

Fischer

produces "specials" every day!



When applied to precision nuts, "special" denotes more than just non-standard sizes, shapes and threads. It also means that advanced production facilities, specialized quality controls and extensive experience are necessary to produce and supply uniformly accurate custom nuts.

With production records on more than 3,457 different types of special nuts . . . both brass and aluminum . . . Fischer is capable of mass producing turned nuts to *your* exact specifications. In fact, all Fischer nuts are made to closer tolerances than required by American Standard B18.2-1955 specifications.

As the leading producer of turned nuts, Fischer also specializes in dependable "on schedule" deliveries and competitive pricing. Whatever your requirement, let Fischer quote on your next order for precision nuts . . . standards, specials or miniatures.

TURNED NUTS Fischer SPECIAL MFG. CO. CINCINNATI SINCE 1908

FOR DETAILS, WRITE FOR CATALOG FS-1000 AND PRICE LISTS.

there's no premium for precision at Fischer

FISCHER SPECIAL MFG. CO.

496 MORGAN STREET · CINCINNATI 6, OHIO

2004-FS

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capacity of unit may be pre-selected.

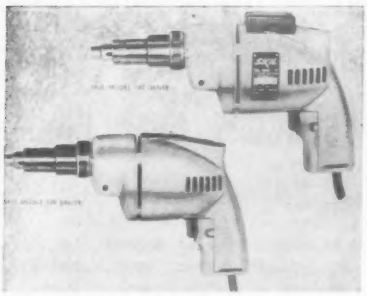
The small size (1½" diameter) and long stroke of the drill permits quick setups to handle special jobs.

Commander Mfg. Co., 4225 W. Kinzie Ave., Chicago 24, Ill.

Use postpaid card. Circle No. 14

POSITIVE CLUTCH, ELECTRIC FASTENER ASSEMBLY TOOLS

Two positive clutch screwdrivers and nut runners deliver torque as long as pressure is applied by the operator. The clutch disengages when the operator lifts the driver.



Both Model 139 and reversing Model 140 have capacity for No. 10 wood and tapping screws and No. 12 machine screws and nuts. They have trigger switches, pins for locking in "on" position, quick change finder, ball thrust and sleeve bearings. Model 140 has reversing switch mounted on top of aluminum housing.

Skil Corp., 5033 Elston Ave., Chicago 30, Illinois.

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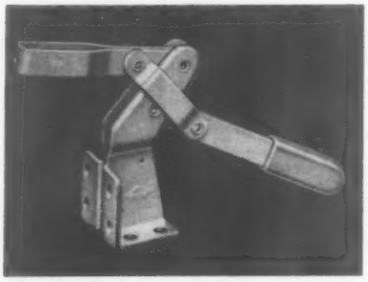
FLIPPER-TYPE CLAMP EASES WORK REMOVAL



Model 320, base-mounted, "flipper"-type clamp, particularly useful where maximum clearance for removal of the work is required, has been added to a line of fixture clamps.

The "U" formed bar of the new clamp accommodates a 5/16" spindle. All bushings and rivets are hardened for greater strength. The entire clamp is cadmium-plated. Over-all height is 3¼".

Wespo Division, Vlier Engineering Corp., 26935 West Seven Mile Rd., Detroit 19, Mich.

Use postpaid card. Circle No. 16

ELECTRONIC TAPWELDER JOINS ALLOY WIRES

Resistance alloy wires of .025" to .0007" diameters are joined at production line speeds by an electronic tapwelder.

The Model W-2 welds without pressure and hence does not flatten, stretch or distort the wire, or embed it in the core. The instrument welds to the exact turn needed, avoiding resolution loss and end coil.

The operator selects the prescribed voltage for a given alloy and diameter of wire. He presses the foot switch, places the tap lead against the coil turn and the weld is accomplished instantaneously by capacitor discharge. Maximum power consumption is 30 watts.

The Hanjohn Co., Inc., 2711 E. Foothill Blvd., Pasadena, Calif.

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brazing handbook

Contains Information On . . .

- Preform advantages and selection.
- Types of Blanked and Edgewound Washers.
- Alloy calculation charts.
- Features of No Tangle Notch Coil Rings.
- Silver and Aluminum Brazing Alloys — Soft Solders.
- Types of Flux and application.

Send for your free copy today!

LUCAS-MILHAUPT *Engineering Co.*

5060 South Lake Drive, Cudahy, Wisconsin

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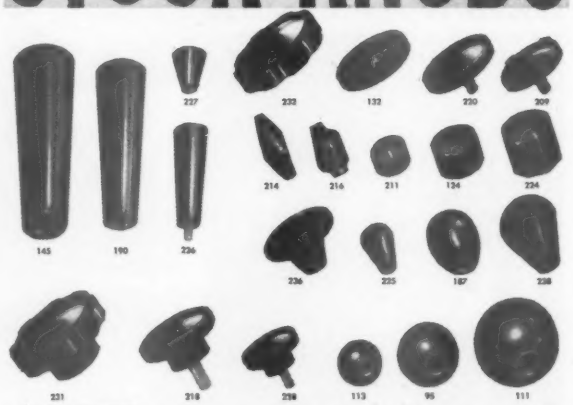
STOCK KNOBS

...NO TOOLING CHARGE!



Wide selection molded plastic knobs, handles, hand-wheels at no tooling charge! Minor changes (inserts, threads, color, etc.) to suit requirements. Other modifications give your part a look of exclusive design at fraction of new mold cost! Write for complete illustrated catalog, or see Sweet's Product Design Catalog File.

DIMCO-GRAY COMPANY

210 EAST SIXTH STREET — DAYTON 2, OHIO

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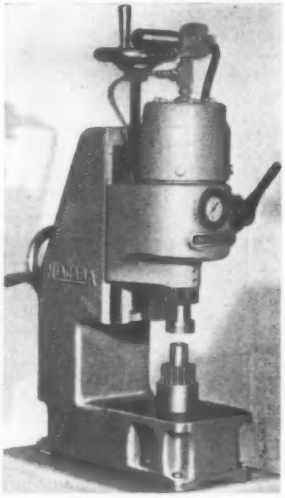
AIR ASSEMBLY PRESSES FROM ½ TO 2 TON



A completely new line of single-acting air presses is designed for assembly operations. Twenty-eight models offer a selection for punching, swaging, staking, upsetting and imprinting. Four press sizes range from ½ to 2 ton capacities at 85 psi. The line includes a choice of three air and three electrical control systems. Equipment for specialized applications is available.

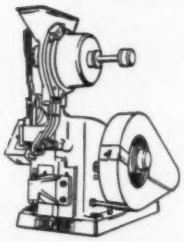
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y.

Use postpaid card. Circle No. 18

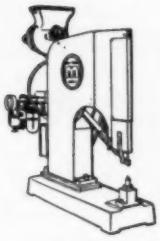
PLASTIC CONTAINER FOR PARTS ASSEMBLY

Molded plastic parts containers stack securely for either permanent or temporary assembly areas. The one-piece containers are stocked both green or yellow and four different sizes ranging from 3"x3½"x1¾" to 8½"x5"x4½". Each has a vertical divider.

Plastibox mounting rails are available in 18" and 36" lengths to mount four or eight containers of the three smaller



Model 52-S-55



Model 56

Model 250

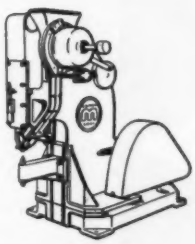
MILFORD'S FLEXIBLE RIVETER LINE CAN HELP CUT YOUR ASSEMBLY COSTS

Bench or Pedestal Models
Mechanical or Pneumatic Operation
Single or Multiple Spindle

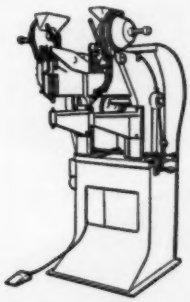
Milford adapts to your production line with a wide range of automatic riveters designed to cut assembly costs. Count on Milford's versatility to come up with the answers you need at substantial cost savings over other fastening methods.

Milford's MANUAL OF RIVETING PRACTICE may have the answers to your riveting and assembly problems. Ask your Milford Representative to show you how to use the ideas in this manual to cut production costs.

Model 423



Model 53



Model 72

THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • NORWALK, CALIFORNIA
ELYRIA, OHIO • AURORA, ILLINOIS • HATBORO, PA

Use postpaid card. Circle No. 259

sizes or three or six larger containers.

G.B. Lewis Co., Dept PB, Watertown, Wisconsin.

Use postpaid card. Circle No. 19

90° ANGLE-HEAD AIR TOOLS WITH ADJUSTABLE CLUTCHES

Two new series of 90° angle-head fastening tools for air-powered nut-running and screwdriving have adjustable clutches for closer torque regulation.

Designed for continuous industrial operation where clearance is limited to ½" offset, the tools feature a spring-loaded clutch with torque output adjusted by a tamper-proof hex nut on the clutch assembly.

All-steel angle-head assembly includes separate gears and pinions for quick, economical replacement when required. Tools can be easily converted from nut-runner to screwdriver by replacing a work spindle.

Available in speeds ranging from 600 to 3500 rpm, the tools are built in both reversible and non-reversible models and carry ratings up to ¼" machine screw.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio.

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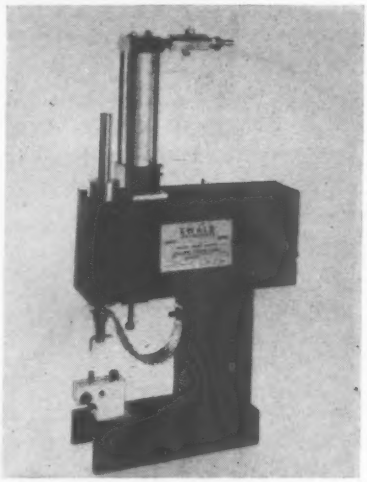
AIR-OPERATED BENCH WELDING HEAD



An air-operated welding head for the production welding of small parts has electrode pressure adjustable from 1 to 20 lbs. indicated on a calibrated scale. The pressure arm moves in linear ball bushings and has very low inertia (4 oz.) to insure fast follow-through forging action.

By controlling the air flow in the air-operated head, sustained pressure is achieved and sparking, excessive electrode wear and unreliable welding due to bounce are eliminated.

The WHD 4AP head can be actuated by an airwave or it can be supplied with a built-in solenoid valve for actuation by footswitch. The head can be used with stored energy power supplies up to 200 watt-seconds or AC welders up to 2½ kva at welding times up to 10 cycles.

Ewald Instruments, Kent, Conn.

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CONVEYOR FURNACE FOR HYDROGEN BRAZING

A hunchback conveyor furnace has been designed for controlled hydrogen atmosphere brazing of components for a new semiconductor product.

The furnace features an elevated heating chamber (2050°F) with inclined loading (Type BAC-12M) and unloading sections. Special instruments control dewpoint of the atmosphere supply entering the furnace to a value which insures controlled "wet-ability" of the bonding material.

C. I. Hayes, Inc., 840 Wellington Ave., Cranston, R.I.

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NEW
STAMPED FASTENERS BY CREST PRODUCTS
WASHER NUT One Piece
ACORN NUT
REGULAR NUT
WING NUT
Available in heat-treated Spring Steel . . . in all popular sizes and finishes.
Crest specializes in custom building fasteners to meet your exacting, individual specifications.
WRITE FOR COMPLETE TECHNICAL DATA
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CREST PRODUCTS, INC.
P. O. BOX 64, UNION, NEW JERSEY

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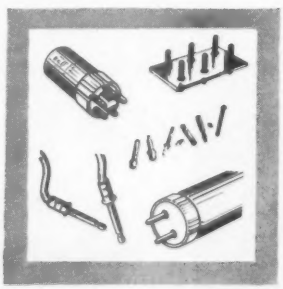


SMALL SWAGED PARTS FOR EVERY NEED BY

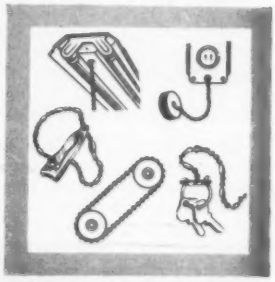
AUTO-SWAGE

"The automatic swaging method"

Since this process reduces metal, rather than cutting it away as by screw machine and eyelet operations, it greatly reduces scrap metal and lowers cost.

Auto-Swage will help design and develop your special needs, such as: connectors, terminals, radio and fluorescent tube pins, shafts, spacers, studs, fasteners; guide, hinge, stop and shoulder pins; small eyelet or headed-type parts and others.

Write for more information about small swaged parts and BEADED CHAIN.



AUTO-SWAGE PRODUCTS, INC.
271 CANAL ST. SHELTON, CONNECTICUT

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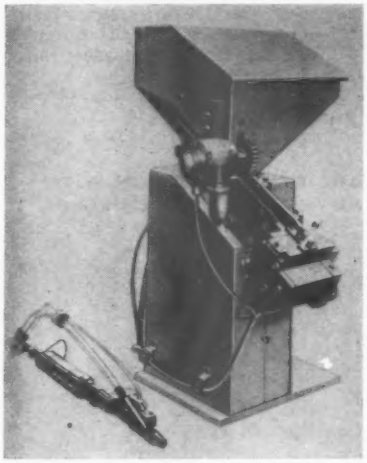
AUTOMATIC SCREWDRIVER FITS STANDARD UNITS



A automatic screw feeder-driver has been redesigned for adaptability to all standard air and most electric screwdrivers.

The JS-60 Jet-Setter can be used with screw of any diameter from No. 2 through No. 14 and is convertible to Phillips, slotted, hex or clutch drivers and any head style. It also handles preassembled fastener-washers.

Portable to any part of the assembly line, the unit permits driver operation up to 20 ft. from the feeder mechanism. Up to 50 screws per minute can be driven.

Parker-Kalon, Div., Clifton, N.J.

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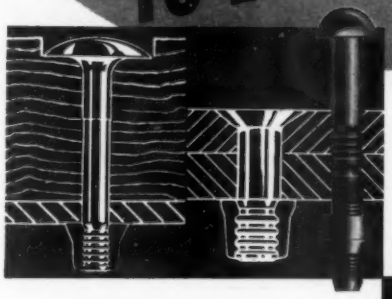
SILICON RECTIFIER POWERS STUD WELDING EQUIPMENT

A silicon rectifier power source, designed by Westinghouse for use with Nelson stud welding equipment, provides direct current for welding studs up through 5/8" diameter. It reaches maximum output in less than one cycle.

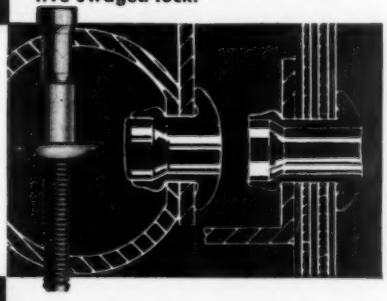
Surge arc has eight levels of current output, appropriate for stud diameters from 3/16" to 5/8". The unit operates from three-phase, 60-cycle ac of either 230 or 460 v. For heavy duty power, two units may be paralleled

ONLY HUCK OFFERS ALL FIVE WAYS TO LOWER ASSEMBLY COSTS.



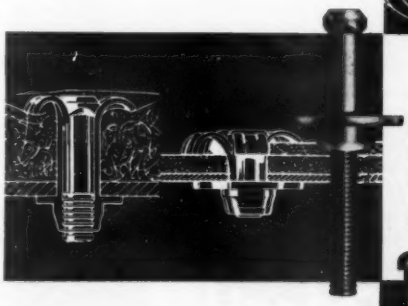
THE HUCKBOLT®

Engineered for soft core panels, wood, plastics, as well as metal-to-metal use. Complete assortment of headstyles for any application. Full range of sizes and materials. Great strength, positive swaged lock.



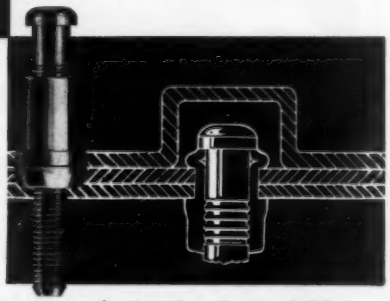
THE 9SP & PT

Low cost, blind fasteners for joining dissimilar materials, fast and easy to install. Solid core provides high shear strength or pulls through in PT to provide grommet hole.



THE DAISY®

A very broad bearing, wide grip range blind fastener for metal-to-metal or soft material use. Fast, uniform, economical. Has positive swaged lock.



THE OS

A structural blind rivet with aluminum alloy sleeve and pin. High clinch and shear strength. Wide bearing and self-sealing. Use in metal, plastics or wood.

Huck's complete line of fasteners and simple, dependable installation tools offer speed, uniformity and economy for most fastening operations. Every Huck fastener is carefully engineered for its job. Our experienced fastener engineers will gladly help you in selecting the best fastener for your use.

HUCK MANUFACTURING COMPANY

2480 Bellevue Avenue • Detroit 7, Michigan • Phone WA 3-4500

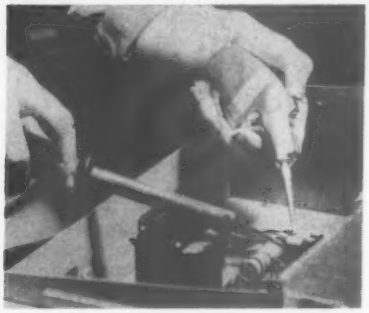
Use postpaid card. Circle No. 262

to weld granular flux-filled studs 1" in diameter.

Nelson Stud Welding Div., Gregory Industries, Lorain, Ohio.

Use postpaid card. Circle No. 24

TOOL DISPENSES RANGE OF WIRE SOLDERS



Kormat dispenses wire solder with a push button feeder adjusting the right amount of solder for each application. It handles wire from .028" to .074" in diameter.

The tool is equipped with a 20 ft. roll of 60/40 rosin core solder of .050" diameter wire. Flip action reloads wire solder in seconds. A selection of attachments includes straight or curved probes in several lengths.

Products For Industry, 220 S. Rose St., Los Angeles, Calif.

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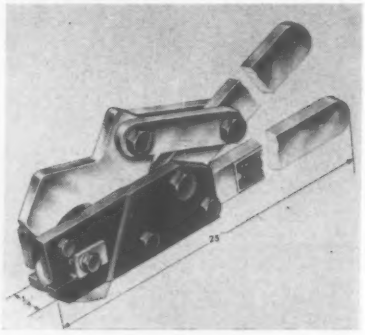
TOOL PUNCHES, CLIPS UP TO 3 SHEETS OF 20 GA.



Wherever two or more pieces of metal need to be joined, a universal clip punch can be considered. The action of closing and opening the handles punches through three sheets of 20 gage mild steel, flattens out the lug and squeezes the metal together.

Thor Tool and Die Co., 865 Estabrook St., San Leandro, Calif.

Use postpaid card. Circle No. 26

ALLOY STEEL FOR PARTS ELIMINATES HEAT TREATING

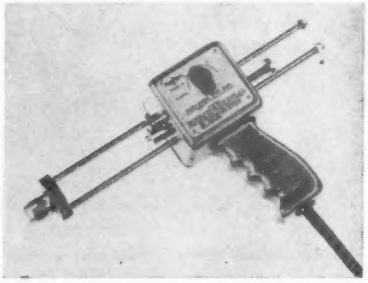
An alloy steel bar, with a guaranteed minimum 150,000 psi tensile and hardness of Rc 32, eliminates the need for heat treating and other secondary operations. It is suitable for fasteners, shafts, gears, pinions and other parts.

The properties of e.t.d. 150 are normally obtained only by quenching and tempering. The 4100 series .40 minimum carbon alloy steel is available in rounds 7/16" through 3-1/2". Tolerances range from .005" to .008".

LaSalle Steel Co., Box 6800-A, Chicago 80, Ill.

Use postpaid card. Circle No. 27

ARC-SPOT WELD GUN WITH AUTOMATIC TIME CONTROL



Automatic time control insures uniform welds from one side without back up on the Model H arc spot weld gun. No triggers or buttons are used during welding.

The tool weighs two pounds, welds 14 gauge to any thickness (minimum 2 pieces, 26 gauge) and welds mild steel, galvanized and stainless.

Bren Weld Corp., 5114 Third Ave., Brooklyn 20, N.Y.

Use postpaid card. Circle No. 28

for sealing –
NOW – IT COSTS NO MORE
for the superiority of
Stat-O-Seal
"PARKY" and his 'O-Seal' family: Parker O-Rings, Lock-O-Seal®, Gask-O-Seal®, Stat-O-Seal®, Rir-O-Seal®, Met-O-Seal®, Electr-O-Seal®
Before fastening
After fastening

From high vacuum to 20,000 PSI and −85°F. to +360°F., only Stat-O-Seals offer safe, sure, effective sealing using the principle of controlled confinement of the seal plus **mechanical** bonding.

They will not "twist" in installing and there's no chemical bonding agent that can be attacked by corrosives . . . and: metal-to-metal contact; quick, visual inspection; simple, one-piece assembly; re-useable; o-ring style configuration for versatility and freedom from damage.

By the makers of Parker O-rings and Gask-O-Seals.

Parker SEAL COMPANY
CULVER CITY, CALIF. • CLEVELAND, 12, OHIO
A DIVISION OF Parker Hannifin CORPORATION

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Speed Tying Operations!

★ Cheaper than String
★ Faster than Tying
★ Sure Grip
★ Colorful

H.F. Hanscom & Co., Inc.
5 Virginia Avenue
Providence 5, R. I., U.S.A.

Top view of Hanscom-Tie is shown. Bottom is flat

NO KNOTS TO TIE!

Cut your tying time in half! Hanscom-Ties are the fast, sure way to bundle wires, cords, coils, etc. Nothing to tie. Just wrap 'em around and twist. For temporary or semi-permanent holding. Available in cut lengths 1" to 24" and on spools — bright colors or printed. Prices from 26c per thousand. WRITE FOR SAMPLES and TRY 'EM YOURSELF.

Hanscom-Ties

Use postpaid card. Circle No. 264

EXTENDABLE WORK HOLDER FOR ELECTRONIC ASSEMBLY

A floor model work holder for electronic assembly handles loads up to 400 lbs. and is extendable to any length requirement.

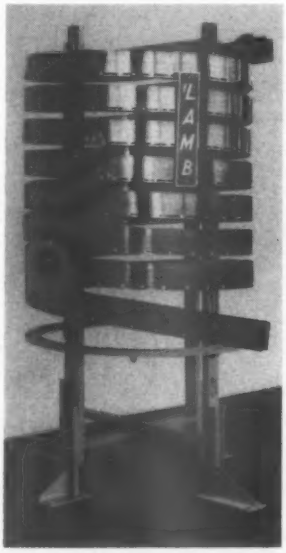
The Tronic-Hold T-310's ability to handle large chassis or harness boards is due to its sliding frame design, which allows the work clamps to be shifted together or apart along a variable length of steel box channel.

The height of the work holder may be varied from 33" to 45" and the work rotated through a full 360°.

Flotron Industries, Inc., 1608 Centinela Ave., Inglewood 3, Calif.

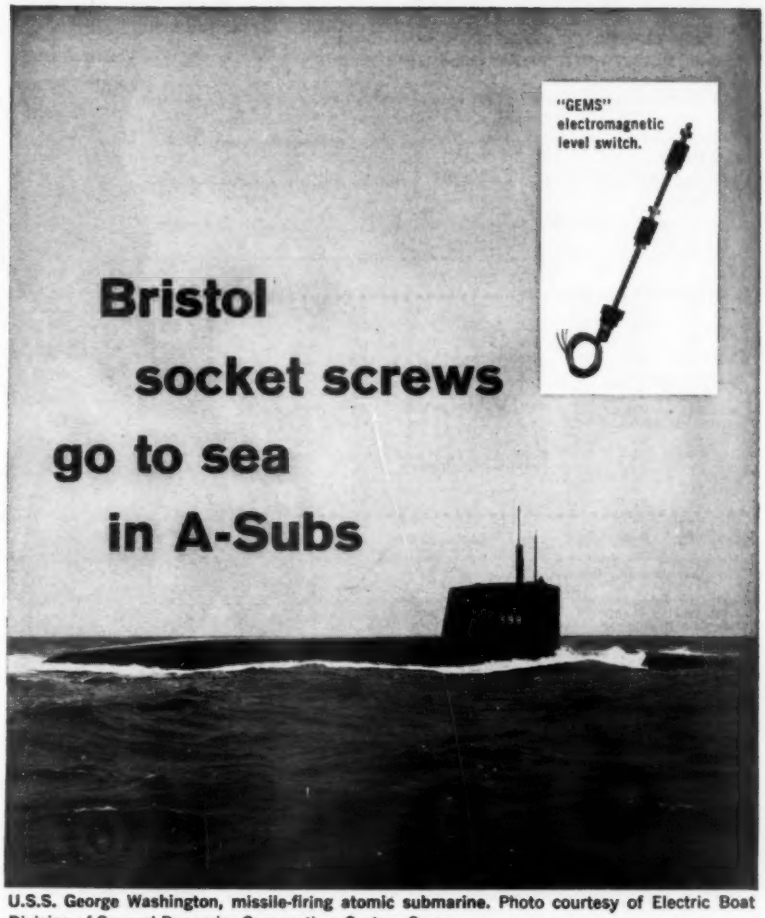
Use postpaid card. Circle No. 29

HELICAL PARTS STORAGE AND LOWERING UNIT



A helical storage and lowering unit is finding wide application in automatic part handling installations.

The unit comprises a Fabri-Flex chuting coiled around and attached to a frame. Part flow is gravitational and constant. The unit can be assembled to conform to space limitations, minimum 10" diameter. Chuting configuration can be reworked to accommodate part design changes.



U.S.S. George Washington, missile-firing atomic submarine. Photo courtesy of Electric Boat Division of General Dynamics Corporation, Groton, Conn.

Bristol Multiple-Spline socket screws are playing an important part in "GEMS" switches, used on some of the U. S. Navy's newest atomic submarines.

The GEMS Company, Newington, Conn., has standardized on the Bristol Multiple-Spline socket screw for use in their line of level switches, flow switches and other special switches. GEMS (stands for "Guaranteed Electro-Magnetic Systems") likes the Multiple-Spline because it takes tighter wrenching and because the distinctive spline design tends to prevent mechanics from disturbing critical calibration-holding screws without proper test equipment.

This application is just one of thousands of jobs Bristol Multiple-Spline socket screws are doing in today's complex technology. They're ideal for electronic computers and communications equipment, appliances, desk calculators and other office equipment, precision machine tools, and a tremendous variety of other equipment.

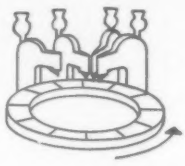
Bristol socket screws are available in a complete line from leading industrial distributors. Both cap and set screws come in industry standard hex socket, as well as in the Bristol-originated Multiple-Spline sockets—sizes as small as No. 0. See your Bristol distributor; he can give you complete information on sizes and types available and fill your requirements with fast delivery from complete distributor stocks. A.O.3

SEE US IN BOOTHS 407-409 AT THE PRODUCT ENGINEERING SHOW

Use postpaid card. Circle No. 265

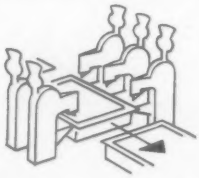
A FEW OF MANY POSSIBLE RIVETING HEAD POSITIONS THAT CAN BE USED

Rotating fixture showing suggested arrangement of riveting heads.

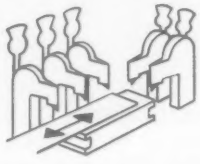


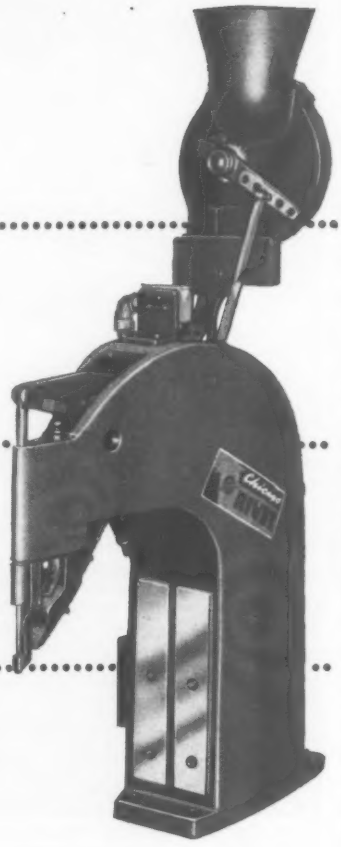
Riveting heads can be positioned for fastening on flat or curved assemblies.

Conveyor Belt permits multiple setting on both sides of an assembly.



Sliding fixture used for riveting 2 sides of an assembly.





AUTOMATE RIVET SETTING

for new low costs

For years assemblies made of metal and non-metal or a combination of both have been fastened most economically with semi-tubular rivets. And now even lower costs are possible with the thin-nose riveting heads designed by Chicago Rivet. These heads, pneumatically operated but electronically controlled, can be grouped in clusters on one or more planes and will set rivets as close as $^{13}/_{16}$" apart. Automation, thru rotating sliding or continuous belt feeding and riveting stations, is possible. Riveting heads may be repositioned and used again on new assemblies.

CUSHIONED RIVETING REDUCES BREAKAGE

A pneumatic riveter upsets the rivet with a squeezing action which minimizes breakage and automatically compensates for slight variation in assembly thicknesses.

The suggestions of Chicago Rivet fastening specialists will prove most helpful. Call them—no obligation.

AIR-POWERED RIVETING CATALOG contains description and specifications of 8 single and multiple riveters—also rivet setters designed for automation.

RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

Chicago Rivet & MACHINE CO.

946 So. 25th Ave., Bellwood, Ill. (Chicago Suburb) • **Branch Factory: Tyrone, Pa.**

Use postpaid card. Circle No. 266

Non-jamming and self-cleaning, the Helical Unit is available in floor type or suspended model.

F. Jos. Lamb Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

Use postpaid card. Circle No. 30

COILED NYLON AIR HOSE SPEEDS ASSEMBLY

A self-coiling nylon air hose that stretches and recoils like a telephone cord can be connected to air lines with quick-disconnect fittings. It speeds assembly and aids house-keeping when used with air tools.

Nycoil, in its retracted position, coils to only a few inches. It is available in standard 25 ft. lengths with reusable fittings on each end.

The Nycoil Co., Box 296, Westfield 5, New Jersey.

Use postpaid card. Circle No. 31

RESISTANCE SOLDERING UNIT FOR PRINTED CIRCUITRY

A resistance soldering machine is especially adaptable to printed circuit board applications.

Tip heat on Velco 197 is controlled by varying the current, and by an adjustable timer, to give complete control of the joint temperature. This assures wetting of all surfaces with a minimum of excess heat. The heating cycle is trigger initiated.

For printed circuit work, the portable device can be adjusted to give a high local heat for solder flow in a limited area.

Virginia Electronics Co., Inc., River Rd. and B&O Railroad, Washington 16, District of Columbia.

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assembly and fastener engineering

SEPTEMBER, 1960

(Not valid after November 30, 1960)

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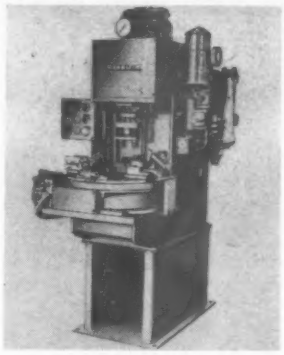
4-TON ASSEMBLY PRESS AT MACHINE TOOL EXPOSITION



A new four-ton press can be equipped with indexing tables for high speed assembly. The FD Series will be on display in action at the Machine Tool Exposition—1960 in Chicago.

The hydraulic press will be set up to press assemble back-up washers on leak-proof straight thread fittings.

Hannifin Co., 501 S. Wolf Rd., DesPlaines, Ill.

Use postpaid card. Circle No. 33

PIVOTING SHELF ATTACHES TO MACHINE COLUMNS

Solving the "where to put it" problem of machine operators is a 16 gauge steel pivoting shelf that can be attached to the column of a machine.

Piv-O-Try holds up to 50 lbs. of parts, tools, oil cans, etc. A 90° lip on three sides and a 45° lip on the front protects against tool travel. It measures 10"x10" and may be used singly or in pairs.

E. V. Nielsen Inc., 575 Hope St., Stamford, Conn.

Use postpaid card. Circle No. 34

HIGH TEMPERATURE FASTENERS
Engineering Catalog Number 286 on request
Manufacturers AN—N.A.S.—M.S. 6 Digit Hardware
SPECIALS TO YOUR SPECIFICATIONS
Mercury air parts co., inc.
9310 West Jefferson Blvd., Culver City, Calif.
Telephone—UPton 0-5923—Teletype—CVR CY 4138
TOUGH SPECIALS 10 DAY DELIVERY
MANUFACTURERS OF PRECISION HARDWARE
Use postpaid card. Circle No. 267

Weigh the facts

OF HARPER'S GREATER BOLT STRENGTH

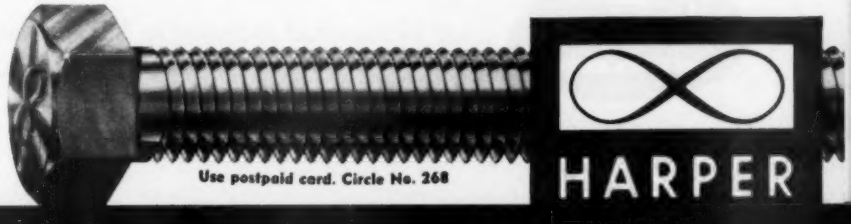
Based on comparative tests of ½—13 x 4" Finished Hexagon Head Type 304 Stainless Steel Machine Bolts.

ANOTHER BIG HARPER Difference!

Substantiated proof of Harper's great bolt strength was made by the Robert W. Hunt Company, in an unbiased test of Harper's products and three other manufacturers. Tests showed that Harper products had 35% greater tensile, 15% greater shear and 26% greater yield strength. This great strength, when added to the corrosion-resistant qualities of every Harper fastening, gives you the best that money can buy. It means increased service life and customer satisfaction. It also means *another Harper difference* to build goodwill for you and your products! See the yellow pages for your nearest distributor.

Write today for FREE Harper "Thread" Brochure

THE H. M. HARPER COMPANY
8214 Lehigh Avenue • Morton Grove, Illinois



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NAT'S
quick facts
about
Fasteners...

Welding Fasteners...

the little things that make a big difference

Welding Fasteners put threads into the most unlikely places, and make light of the weightiest assembly problems.

Where hands and wrenches can't get in, for instance, or where material dimensions or contours make it next to impossible to use regular fastening methods, Weld Nuts or Weld Screws neatly side-step the difficulties . . . and make assembly simple, fast and foolproof.

We could go on and tell you more about Welding Fastener advantages . . . in improving product design and quality, increasing production efficiency, and cutting costs . . . and we'll be very glad to, if you like.

Right now, though, we'd just like to say that when you need certain standard Weld Nuts or Weld Screws, and you want to be sure they're designed right and made right . . . that's where we come in. We *know* Welding Fasteners, and we *stock* many of the most commonly used.*

We might just mention, too, that we happen to be particularly adept at developing Special Fasteners for welding. They can often be designed to do a better job and save money for you. Ask us about your applications.

*Standard types and sizes are illustrated and listed in National's booklet on Welding Fasteners. Write for your copy.

National PRODUCTS

The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

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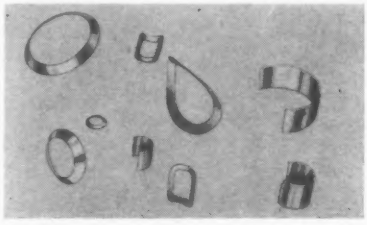
WHAT'S NEW IN FASTENING AND JOINING

For further information on any of the fasteners or methods listed here, use the handy postpaid card opposite page 82.



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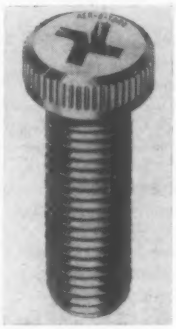

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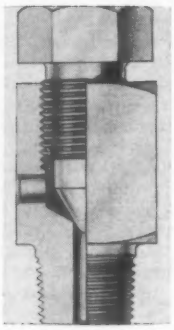

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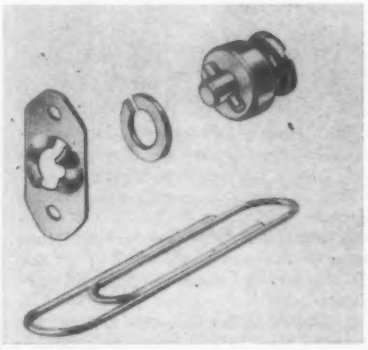


(See 41)

CURVED PREFORMS FOR TUBULAR BRAZING

A new concept in preform designs for tubular brazing has been developed: curved washers and shims are now custom manufactured of silver alloys.

Applications on which one tube is radiused or saddled to fit over another are often difficult to preform with a washer or shim. The stiffness of the washer may hold the radiused member away from the other tube. By curving the washer to the curvature of the tube, the problem is minimized.

Lucas-Milhaupt Engineering Co., 5051 S. Lake Shore Dr., Cudahy, Wis.

Use postpaird card. Circle No. 40

QUARTER-TURN FASTENER WITH HIGH CLAMPING FORCE

A sub-miniature quarter-turn release fastener series is designed for light covers, small sub-assemblies and miniature "black boxes." They provide a high clamping force with an ultimate tension-shear rating of 150 lbs. in minimum envelope dimensions.

The 12F receptacle provides reduced size with ½" rivet spacing yet uses standard .062" diameter rivets. Actual envelope dimensions of receptacle are .285" wide, .680" long, .102" high.

A spring in the stud assembly provides superior reach characteristics. Stud assemblies are available in length increments of .015" to insure adaptability to all grip range requirements.

Standard cadmium plate on carbon steel in accordance with QQ-P-416, Class 2, Type II. Stainless finish is plain, passivated per MIL-S-5002.

Camloc Fastener Corp. Dept. 2A, Spring Valley Rd., Paramus, N.J.

Use postpaid card. Circle No. 41

AIR BLEEDER VALVE FOR HYDRAULIC CIRCUITS

An air bleeder valve for hydraulic circuits is designed to be installed at the highest point in the hydraulic circuit, the point at which air accumulates. It permits elimination of all air from the system, especially important when a hydraulic system is started.

With only two metal parts, no packings are employed in the valve. The valves are available in a range of sizes in cadmium plated steel, and in stainless steel on special order.

Lenz Company, 3301 Klepinger Road, Dayton 1, Ohio.

Use postpaid card. Circle No. 42

CAP SCREW'S HIGH TORQUE RECESS ADDS STRENGTH

A cap screw has been perfected to use a new type of recess for high torque strength.

The Aer-O-Torq recess requires less metal for a given necessary driving torque. The screws thereby have less metal in the heads and are up to 35% shorter. Screws are reported to torque higher, distribute load over wide bearing surfaces and provide more wrenching power and clamping force without indenting the work, up to 400 in.-lbs. with standard ¼-28 alloy cap screws.

Low contour of the head allows them to be used in hard-to-get-to places.

Aer-O-Line Mfg. & Supply Co., 3110 Winona Ave., Burbank, Calif.

Use postpaid card. Circle No. 43

CONTACT TYPE ADHESIVE FOR PANEL ASSEMBLY

Volume users of adhesives for bonding laminated and decorative plastic materials or other types of panel materials to metal or wood will be interested in Bostik 206-281. It is suitable for both spray and machine-type roller-coating applications.

The new adhesive is a contact type with fast solvent release. It is heat resistant to 180°F and may be used with little or no forced drying depending on speed of assembly line work in process.

B. B. Chemical Co., Cambridge, Mass.

Use postpaid card. Circle No. 44

ELIMINATE EXTRA STEP IN BRIGHT NICKEL PLATING

High-level nickel plating can be a two-step, rather than three-step, process. Hi-Thro provides the base nickel layers with an inherent re-

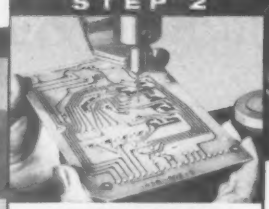
3 STEPS
TO EXCELLENCE
IN PW BOARDS

STEP 1

FUNNEL FLANGE EYELETS

Only the United Funnel Flange Eyelet contributes that greater mechanical strength, improved reliability and uniform circuitry so necessary for achieving a superior PW or Etched Circuit Board. Wide range of sizes and lengths meet all board needs.

STEP 2



AUTOMATIC EYELETING MACHINES

Only United offers such a complete line of Eyelet Setting Machines, backed by more than 50 years' experience with precision production machinery for industry. The United Model G Eyeleting Machine feeds eyelets automatically, compensates for variations in board thicknesses for more dependable production.

STEP 3

COMPONENT INSERTING MACHINES

Only from United — a complete line of high precision DYNASERT Component Inserting Machines that cut component inserting costs up to 80%!

DYNASERT Machines automatically feed, trim, bend leads, insert components and clinch with uniform results. If you insert only a few hundred components a week DYNASERT machines should be considered.

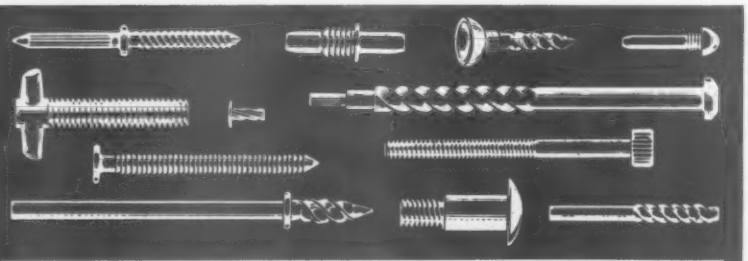
These "3 Steps to Excellence" — Funnel Flange Eyelets, Automatic Eyeleting Machine, and Component Inserting Machines . . . can provide that vital extra margin of dependability and value in your PW or Etched Boards. And the investment is surprisingly small. Call or write for complete details.

United

UNITED SHOE MACHINERY CORPORATION

140 Federal Street, Boston, Mass. • Liberty 2-9100

Use postpaid card. Circle No. 270



Job-Designed Threaded Parts for Every Industry

Hassall

Here is a fast, dependable, low cost, quality minded source of supply for JOB-DESIGNED threaded parts and fasteners of all types, in any metal, to fit your own particular assembly problem. Recognize the fact that a fastener designed specifically to fill a seemingly complex assembly requirement can easily cost less than design modification to accommodate so-called standard rivets. Assembly costs are a very major part of manufacturing expense. Most of this is labor. The fastening medium itself is usually a minimum item. If a Job-Designed fastener makes assembly simpler and faster, permits the use of fewer fasteners, allows the designer functional freedom and improves product efficiency, yours is a specifying job well done. All these possibilities are available when you come to Hassall for design assistance and quotation on challenging, difficult or unusual rivets, threaded nails, drive screws and other cold headed parts. Short or long runs, pilot quantities, engineering counsel, over 100 years of intimate association with cold heading—and a deep appreciation and regard for the concept of value analysis—all are a part of the Hassall service to you.

Send for a copy of our latest catalog.

JOHN HASSALL, INC.

MANUFACTURERS SINCE 1850

P. O. Box 2217 • Westbury, Long Island, N.Y.

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ceptability to an outer bright nickel coating.

Conventional procedure requires an initial activating treatment of the metals before applying surface layers.

Seymour Mfg. Co., Seymour, Conn.

Use postpaid card. Circle No. 45

ONE-PART EPOXY ADHESIVE FOR VOLUME ASSEMBLY

A high strength one-component modified epoxy resin adhesive is designed for bonding metal and plastic structural assemblies in volume.

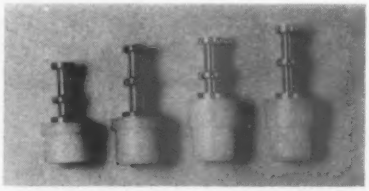
Scotch-Weld EC-1595 has an unlimited working life and will not harden before curing. It contains a latent hardener, eliminating weighing and mixing at time of use.

Metal-to-metal bonds have shear strengths of 2500 psi at 75°F, maintaining strength from minus 67°F to 300°F. The adhesive has high creep resistance and resistance to water, 20% salt spray, hydraulic oil and aromatic fuel. Only pressure contact is required during curing.

Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

Use postpaid card. Circle No. 46

DOUBLE-TURRET STANDOFF TEFLON TERMINALS



Four double-turreted standoff terminals have been added to a line of standard Teflon insulated terminals.

The Cambion terminals are .148" in diameter and press fit into a .136" hole, plus or minues .002". They accommodate panel thicknesses from 1/16" to ¼" and are available in natural Teflon or eight code colors.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Use postpaid card. Circle No. 47

HIGH-CARBON STEEL WIRE WITH 575,000 PSI TENSILE

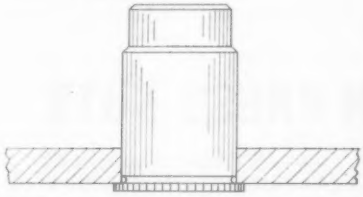
A new high-strength wire having 575,000-psi tensile strength is a high-carbon steel wire (approximately .90% carbon), available in .005" diameters and finer. Larger sizes are expected with slightly reduced tensiles. The wire is available with brass finish in continuous lengths to 2 lbs. and on spools to 10 lbs. in .005" sizes and finer.

Initial uses have been in fabrications with plastic binders to form high-tensile members for military applications. Future uses are expected to include applications requiring higher tensiles than are now available in music, spring and piano wires.

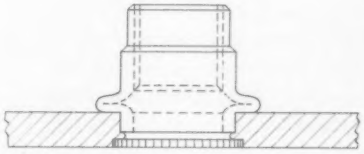
National-Standard Co., 1939 Ward Rd., Niles, Michigan.

Use postpaid card. Circle No. 48

LOCKNUT FOR 125,000 PSI BLIND BOLTING



BEFORE INSTALLATION



AFTER INSTALLATION

A blind-mounting locknut is installed from one side in a drilled hole by a pressure tool. The Davis Press Nut is embedded flush in one surface of the metal while gripping the other by a swaging action.

The stainless steel fastener is designed for use with 125,000 psi tension and shear bolting such as NAS 33, 517 and 1303 and AN-3 series. It can be used in sheets from .040" to .400" thick and of Rockwell hardness up to 21.

The nuts are made in four standard

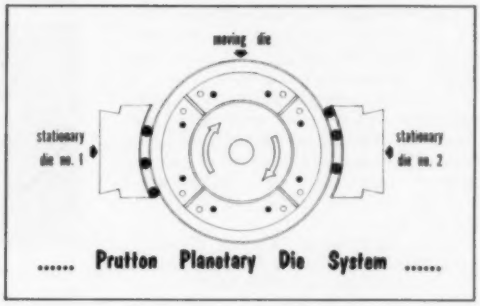
PRUTTON PLANETARY THREAD ROLLING

...produces up to 48,000 pieces per hour!

HERE'S HOW–

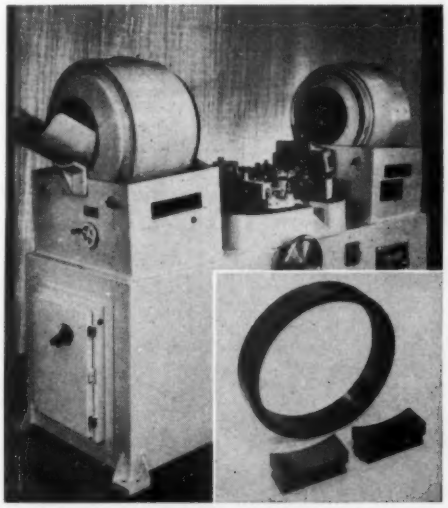
The Prutton Rollmaster takes advantage of a better application of thread rolling principles used in all production thread rolling. An important departure is in the rigidity of the thread rolling dies. Deflection or "spring" is eliminated. Note that a 300 pound forging spindle is supported by two Timken tapered bearings rated at 8 times maximum load.

A set of Prutton RTH Thin-wall Ring Dies consists of a one-piece rotary die and two stationary die shoes. The single round moving die serves both stationary dies simultaneously. Prutton's Exclusive Taper-Lock Die Holder locks the round ring firmly in position with the same action as a chuck on a lathe. It is possible to true up the die to .001 T.I.R. in 10 minutes.



..... Prutton Planetary Die System .....

ELIMINATE "Lost Motion" ON YOUR WORK . . .



Prutton Planetary Thread Rolling Machine Model 125A-24

On a conventional machine only a single blank is rolled with each forward stroke of the moving die. The return stroke accomplishes nothing except to return the empty die to its starting position.

Compared to the old method of making only a single part at a time, a Prutton machine can produce as many as eight threaded parts per cycle. The rotary die is mounted on a main spindle of the machine and the stationary dies are diametrically opposed across the center of the moving die. A cycle is completed each time the moving die completes a 360 degree rotation. There is no lost motion. The number of threaded parts engaged by the die at one time is limited only by the number of starts on the dies. That is how speeds of 600 to 800 pieces per minute are possible with a Prutton Planetary Thread Rolling Machine. These remarkably efficient machines can cut cost as much as 65%. One Prutton can turn out as much work as 4 conventional machines.

The Prutton Planetary Die Principle can be used with equal effectiveness for thread rolling, knurling, marking, serrating and necking of bolts, screws, nails and special parts in a wide range of sizes.

Write or Phone for Cost Saving Information TODAY!

Prutton
CORPORATION
5295 WEST 130th STREET
CLEVELAND 30, OHIO

Leader in Planetary Thread Rolling

JUST PIN THIS COUPON TO YOUR LETTERHEAD

PRUTTON CORPORATION
5295 W. 130th Street
Cleveland 30, Ohio
Dept. AF

Please send information on Model 125A-24 Thread Rolling Machine.

Name ..... Title .....

Company .....

Street Address .....

City ..... Zone ..... State .....

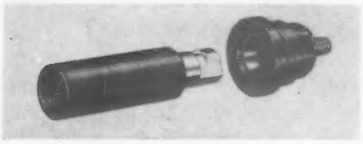
Use postpaid card. Circle No. 272

bolt diameter sizes—No. 10 through 3/8" and in nine grip lengths.

Standard Pressed Steel Co., Jenkintown, Pennsylvania.

Use postpaid card. Circle No. 49

HIGH-IMPACT PLASTIC INSULATED CONNECTORS



High-impact plastic insulated receptacles, plugs and connectors are used for fast direct mounting in electrical panels and for joining and extending portable wires and cables.

The connectors are designed to speed assembly and prevent accidental short circuiting through a "dead front" feature. They are available with various colored insulators for identification and are built for cable sizes No. 18 to 750 MCM.

Cam-Lok Division, Empire Products, Inc., Box 98-T, Cincinnati 36, Ohio.

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IMPACT PLATING AVOIDS HYDROGEN EMBRITTLEMENT

Garrettizing is the name for a system of zinc plating high carbon steel and spring steel parts free of hydrogen-embrittlement.

The parts, after cleaning, etc., are put in a tumbler along with powdered zinc, promoting compound, water and millions of glass beads of varying size. As the loaded tumbler tosses the mixture, the beads strike the parts. The impacting accomplishes the zinc plating.

The process plates uniformly, eliminates discoloration (no baking) and aging.

George K. Garrett Co., Inc., Torresdale Ave. at Tolbut St., Philadelphia 36, Pennsylvania.

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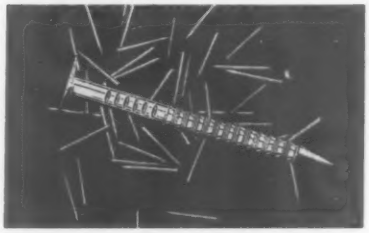
RING BARB NAILS WITH GROOVED SHANKS



Ring barb nails for metal fastening and other applications have ring grooved shanks similar to buttress threads. The grooved shanks improve holding power.

The nails come in a variety of lengths, finishes and package sizes.

Hillwood Mfg. Co., 21700 St. Clair Ave., Cleveland 17, Ohio.

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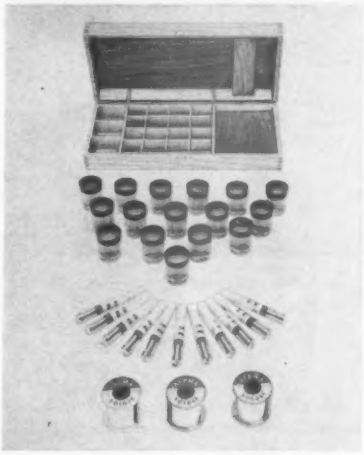
SOLDER AND FLUX KIT FOR DESIGN EXPERIMENTS

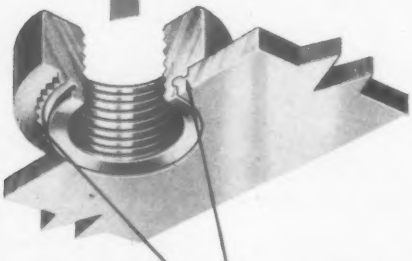


A solder and flux kit will help design and process engineers do experimental pre-production jobs that cannot be done with standard tin-lead solders.

The kit consists of 16 varieties of soldering chemicals—fluxes, solder paste, flux and dross removers and printed circuit board coatings; 11 kinds of flux-filled and solid wire solders in handy dispenser tubes; and three foil solders for making preforms.

The inside kit cover contains a flux finder guide and solder selector chart, a special soft solder alloys diagram and

THE P37 P NUT — THE LATEST IN PRESS NUTS



NO WORK DEFORMATION
Serrations contain all displaced material to eliminate work buckling while shoulder prevents off perpendicular nut positioning.

LIQUID TIGHT LOCK
During press-in, displaced metal flows into retaining groove of the P-NUT to assure a positive lock between the serrations and the drilled hole.

HOLE PREPARATION
A single punched or standard drill size hole matches the P-Nut's pilot diameter.

THREAD SIZES
All popular coarse and fine thread sizes from 4-40NC to 1/2-20UNF are available.

VISUAL INSPECTION
When you see the shoulder bottoms on the work, you know the P-Nut is properly installed.

The P-Nut provides a simple, very inexpensive, method for attaining load bearing threads in thick or thin ductile sheet metal such as aluminum, mild steel and copper alloys.

P-Nuts are pressed into the work with standard hydraulic or pneumatic presses, bench vices or even driven in with a few blows of a hammer. No special installation tools are needed.

The P-Nut's excellent push-out and torque-out values assures a positive lock ...especially desirable for the many vibration and repeated use applications found in the commercial, electronic and aero-space industries.

Write today for illustrated brochure.

hi-shear CORPORATION
2600 WEST 247TH STREET, TORRANCE, CALIFORNIA

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a solder alloy chart. These charts list tensile strengths of various tin-lead alloys, order of solderability and melting points of metals most often encountered in experimental jobs.

Alpha Metals, Inc., 56 Water St., Jersey City 4, N.J.

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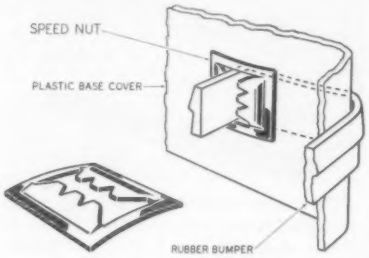
PUSH-ON SPRING-NUT FOR SPECIAL APPLICATION



A new push-on Speed Nut has been designed especially to retain protective rubber bumper strips to vacuum cleaner bases.

Assembly is rapid and simple. The spring steel fastener is slipped over the end of the rubber strip and held against the base while the rubber is pulled through a clearance hole, wrapped around the base, stretched tightly and anchored at the opposite end with another nut. Two triple-toothed prong forms on the fastener bite deep into the rubber strip holding it firmly in place and resisting loosening tendencies due to vibration or service abuse.

Tinnerman Products, Inc., Box 6688, Cleveland 1, Ohio.

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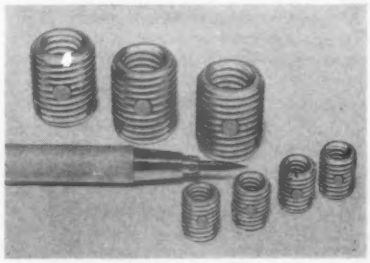
LOCKING INSERTS STOCKED IN STEEL AND STAINLESS



Nylok Tap-Lok inserts are now stocked for immediate delivery. The off-the-shelf items include steel and stainless steel inserts in sizes No. 4 through ½-inch, in medium and regular lengths.

The Nylok series is used in materials which are machinable but of insufficient strength to sustain applied loads in threads tapped directly into the materials. Also, the insert is used where excessive thread wear occurs due to frequent assembly and disassembly.

The insert is a hard bushing with internal and external threads and taps its own threads as it is driven into a

SNAP-ON makes over 1,000 sockets in a wide variety of sizes and types. Your SNAP-ON industrial representative can give you full details.

FOR ALL INDUSTRY

SNAP-ON TOOLS

8033-I 28th AVENUE • KENOSHA, WISCONSIN

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cored or drilled hole. As the full diameter threads become engaged, a limited material displacement occurs which causes a frictional build-up and locking action as the insert is seated.

The internal threads are standard machine screw threads, permitting application of standard threaded fasteners. In the Nylok series, however, a nylon pellet is permanently imbedded in these internal threads.

Groov-Pin Corp. 1125 Hendricks Causeway, Ridgefield, N.J.

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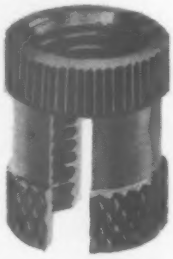
LOCKING THREADED INSERTS FOR PLASTICS, METAL



Locking inserts have been developed for use in plastic parts after molding, soft metals and wood. They are placed in drilled or molded holes.

When the screw is tightened in a Taper-Thread insert the screw expands the tapered threads and locks the diamond knurls of the insert into the hole wall.

Standard sizes range from 2-56 through 10-32 in brass and aluminum.

Fastener Products, Inc., Wilton, Conn.

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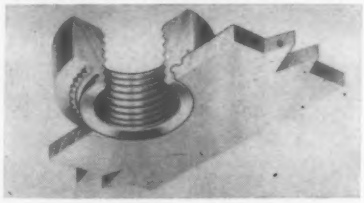
PRESS-IN PANEL NUT WITH HIGH SEAL, STRENGTH



Load bearing threads in plate thicknesses from .032" to .125" are possible with the P-37 P-Nut. The press-in type fastener is available in coarse and fine threads ranging from 4-40NC to ½-20UNF.

The locking serrations at the base of the nut provide a liquid tight seal, as well as produce push-out and torque-out values exceeding MIL-N-25027. Tensile strength exceeds that of 200,000 psi bolts.

Arbor presses, bench vises or hammers can be used for installation.

Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif.

Use postpaid card. Circle No. 57

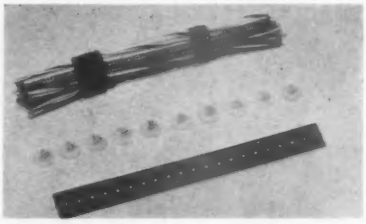
LIQUID PLASTIC SEALS WELDED CONTAINERS

Rubba-Seal, a transparent liquid plastic, adheres to metal, wood, fabric, cork, leather and other surfaces. It is designed for sealing metal boxes and containers fabricated by spot welding. The product can be applied by brush, spray or flow gun to the seam of the container and dries transparent. It resists acids and alkalies.

Rubba, Inc., 1015 E. 173rd St., New York 60, New York.

Use postpaid card. Circle No. 58

INSTALLATION EASE IN WIRE, CABLE STRAPPING



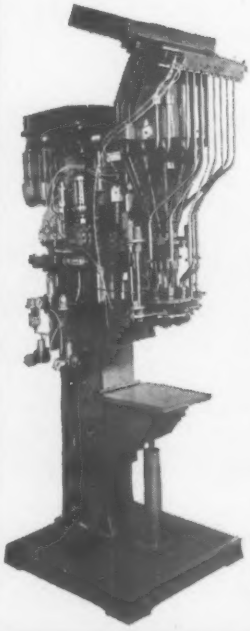
Wire and cable tying offering ease of installation and no waste consists of two components: a high-grade plastic belt (with spaced mounting holes) and a stud-like insert (resembling an old collar button).

Installers simply wrap the strap around the wire or cable to be held and snap-in a stud. Insuloid Strapping system can be used to secure or group all types of unsupported wire and cable in any diameter or form. The strapping comes in 75 ft. coils and two widths.

Electrovert, Inc., 489 Fifth Ave., New York, N.Y.

Use postpaid card. Circle No. 59

this machine will drive up to 10 screws at one time . . .



. . . reducing assembly costs and improving quality. Built for high production jobs where a fixed set up is practical, this multiple spindle screw driving machine automatically feeds screws from a hopper and drives them to a predetermined torque. Evenly distributed pressure eliminates stresses caused by driving home one screw at a time. A simple sliding fixture positions work pieces accurately.

Machine illustrated shows application of multiple spindle screwdriving to assembly of electric power drills.

Send a sample of your assembly and a list of your requirements. We will be happy to show you how multiple spindle screw driving can be applied to your job.

COOK & CHICK COMPANY
2415 West 23th Street Chicago 8, Illinois

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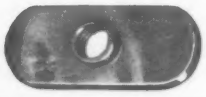
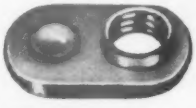
OHIO WELD NUTS

Patent No. 2908310

RN NUT—for projection welding. Ideal where tension is against the weld.
Thread Sizes:
#6-32 to ½-13



ND NUT—for spotwelding. Used where large nut is needed for bridging two sheets or for extra strength.
Thread Sizes:
#6-32 to ⅜-16



PN NUT—for projection welding. Ideal in confined areas, to heavier gages and on curved surfaces.
Thread Sizes:
#6-32 to ⅜-16

Patent Applied For

XN NUT—for spotwelding with recessed target electrode area. Full range of sizes can be welded with 20 KVA Welder.
Thread Sizes:
#6-32 to ⅜-16

Samples and information furnished upon request.

The Primary Fastener in Fastener Assemblies
THE OHIO NUT AND BOLT CO.
30 FIRST AVENUE BEREA, OHIO

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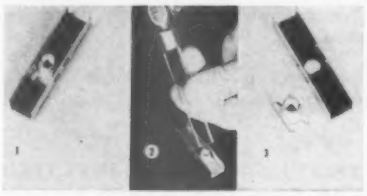
LOCKNUT LIFE LONGER IN GANG CHANNEL



Extended locknut life is the feature of a new tap-out gang channel for use on jet engines and other high temperature applications.

With longer life, the channel has greater reusability. Locknuts can be removed without special tools and inspected individually, without having to remove an entire channel strip and nut assembly.

Kaynar Mfg. Co., Inc., Kaylock Div., Box 2001 Terminal Annex, Los Angeles 54, Calif.

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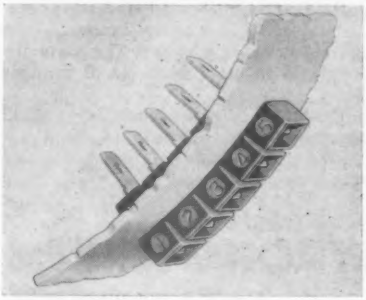
QUICK-CONNECT MINIATURE NYLON TERMINAL BUSHINGS



Junction-terminal bushings, which snap into curved and flat surfaces, are of the miniature accordion type. The nylon insulated receptacles mate with 3/16" and ¼" standard disconnect terminals.

The bushings are available as single or as flexibly connected groups up to five, and are number coded. They are available in colors. Samples.

Heyman Mfg. Co., 1200 Michigan Ave., Kenilworth, N.J.

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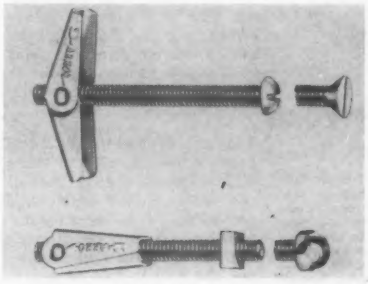
TWO-WING TOGGLE BOLT IN DIAMETERS TO ½"



Versatility to fit a number of difficult fastening jobs has popularized a two-wing toggle bolt. The toggle wings spring open when the hollow area is reached, providing an anchor. The bolt

AUTOMATIC DEGREASING AND CHIP REMOVAL

for all fasteners and small parts . . .

1. Excess oil and chip removal. 2. Elevating feed conveyor. 3. Vibra sub-sonic degreaser. 4. Complete chip removal and conveying to scale. 5. Continuous automatic solvent still and oil reclamation

The Manpro Vibra is a sub-sonic degreaser for automatic high production in-line processing of all types of fasteners and small parts . . .

- **Automatic separation of chips, scrap, and excess oil.**
- **Conveyorized loading and unloading.**
- **Normal floor space only 56 square feet.**
- **Automatic in-line processing.**
- **Extremely low solvent costs.**
- **Easy one-man operation.**

Parts fed automatically are cleaned as they travel up a spiral elevator. The cleaning cycle is by immersion in a hot vibrating solution, washing with clean condensate, and a final vapor cleaning. Parts emerge spotlessly clean and dry. No manpower is required during continuous operation.

The equipment is designed for *high production* degreasing of all types of small parts without the need of baskets, pans, hooks, etc. Sizes available with production capacities of 1000 to 9000 pounds per hour.

Manpro Vibra-Degreasers utilize a unique vibrating spiral elevator to move the work rapidly through non-flammable cleaning solvents and vapors. With only one moving part, minimum maintenance is assured.

MANPRO CORPORATION

Can a Vibra-Degreaser help you? FREE 4 page detailed FOLDER is yours for the asking. Write today.

1360 HILTON ROAD, DETROIT 20, MICHIGAN

Use postpaid card. Circle No. 277

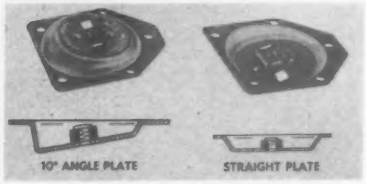
itself is full-threaded to accommodate different wall thicknesses and the trunnion nut is tapped oversize for quick installation.

Three screw-head types are available: round, flat and mushroom. The fastener comes in diameters from ⅛" through ½".

Arro Expansion Bolt Co., Marion, Ohio.

Use postpaid card. Circle No. 62

HANGER BOLT MOUNTING PLATES FOR FURNITURE



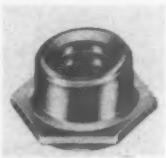
Hanger bolt mounting plates for detachable furniture legs provide a strong, rigid attachment. The design includes a machined nut permanently clinched in place, which can not turn, loosen or push out.

Three attaching screws are used in most installations. The plate will accept hanger bolt projection of full ⅜", instead of conventional ¼", giving increased resistance to side stresses.

Barry New York, Inc., 227 Taaffe Pl., Brooklyn 5, N.Y.

Use postpaid card. Circle No. 63

CAPTIVE LOCKNUTS OF STAINLESS STEEL



A line of captive nuts provides self-locking, stainless steel threaded inserts for use in aluminum or brass.

The machined hex fasteners are easily applied and reliably grip parent metal in a variety of applications. Four available sizes are 4-40 through 10-32 designed for thicknesses from 1/16" through ¼". Special variations for special uses are also available.

National Radio Co., Madison, Mass.

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TWO EPOXY RESIN SYSTEMS FOR CASTING, POTTING

Two types of epoxy resin coating systems have wide industrial application.

Meta-Cast 405 AP is an all-purpose filled system for a wide temperature range (—60° to 200°C). Used with a special low toxicity curing agent, the resin can be converted to an intermediate B-stage solid at room temperature with a minimum of exothermic heat. This makes it desirable for encapsulation of heat sensitive components.

Meta-Cast 441 is a two-part 100% solids compound recommended for sealing, potting and/or encapsulating large items. It can be adjusted from a semi-rigid hard casting to a rubbery, flexible sealant by varying the components.

Mereco Products Div., Metachem Resins Corp., 530 Wellington Ave., Cranston 10, R.I.

Use postpaid card. Circle No. 65

SPLIT HEAD COLLAR INSERT FOR HANDLES, KNOBS

A split head collar insert for plastics assures improved non-slip handles and knobs for electrical appliances.

The stainless steel insert is molded into the plastic with threaded end extended. This greatly increases the fastener's holding power. The parts are available in sizes from No. 6 through ⅜".

C.S.M. Screw Products Co., 2105 Southport Ave., Chicago 14, Ill.

Use postpaid card. Circle No. 66

SYNFLEX

Self-Storing Air Hose

With a working length of up to 23 feet, Synflex Self-Storing Air Hose retracts automatically into a storage coil only 9 inches long — neat and compact for space saving and SAFETY.

Made from a special Nylon formulation, Synflex is lighter and less bulky than rubber hose. Ideal for air-driven equipment — portable or fixed installations. It is kink and abrasion-resistant and impervious to oils and greases. Micro-finished bore and full-flow, reusable fittings assure unobstructed air flow to 200 psi.

Available with ¼" I.D. (S8) and ⅜" I.D. (S12). Brown-orange color gives high visibility — for safety. Full details on request.

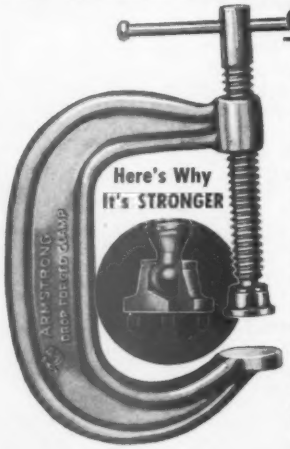
A-2702A

SOME DISTRIBUTOR TERRITORIES OPEN

SYNFLEX
Products Division
Samuel Moore & Co.
Mantua, Ohio

Use postpaid card. Circle No. 278

New ARMSTRONG Swivel Pad can't come off



Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer—yet the pad is free to swivel through an arc of approximately 40°.

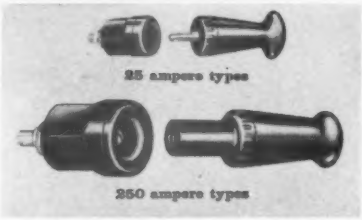
Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

ARMSTRONG BROS. TOOL CO., 5203 W. ARMSTRONG AVE. CHICAGO 46, ILLINOIS

Use postpaid card. Circle No. 279

DESIGN CHANGES IN PLASTIC CONNECTORS



Single-connector plugs and receptacles in 25 and 250 amp. ratings have been added to a line of electrical products.

Supercon plastic molded parts are of fishtail plug design with cable connection to the plug made by either soldering or screw fastening. The grips are of two-piece threaded construction for quick assembly and release.

The Superior Electric Co., 83 Laurel St., Bristol, Conn.

Use postpaid card. Circle No. 67

HOSE, PUSH-ON FITTINGS NOW IN KIT FORM

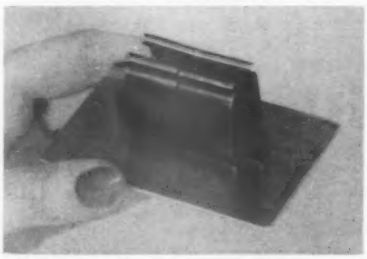
Industrial hose and Push-lok fittings for quick installation of fluid handling circuits are now available in kits.

The one-piece, socketless brass fittings are reusable. The hose is simply pushed over the barbed stem of the fitting. The stem can not be pulled out. Cotton or rubber hose suitable for service under 250 psi pressure is available in either ¼" or ⅜" inside diameter sizes.

Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio.

Use postpaid card. Circle No. 68

SPRING CLIP HOLDS ELECTRONIC COMPONENTS



A holding clip designed for mounting relays, capacitors and similar small square and rectangular components is made of beryllium copper. The new clip insures holding power by permitting both sides to work independently from each other.

The clip will accommodate components up to 1" square or 1" x 2" rectangular. Components are easily removed and replaced despite the strong spring tension. A number of finishes are available.

Atlee Corp., 47 Prospect St., Woburn, Massachusetts.

Use postpaid card. Circle No. 69

Answer to problem on page 66

$$8x - 5(26 - x) = 0$$
$$13x = 130$$
$$x = 10$$

CHECK WITH

chandler

FOR PRECISION CAP SCREWS

You can depend on Chandler for quality, reliability *and service!* Competent Chandler engineers analyze your specific fastening problem . . . follow your order through each stage of production . . . schedule deliveries to meet your requirements. At Chandler, men, materials and machines are efficiently combined in a modern government-approved plant to produce reliable fasteners that meet military and industrial standards. And Chandler's complete laboratory *guarantees reliability* . . . provides chemical and metallurgical control as well as tests of tensile, yield, creep and stress rupture. If you require precision cap screws or bolts, check your Chandler before you place your next order. Send for your Chandler catalog today.

CP chandler products corporation
1543 Chardon Road, Cleveland 17, Ohio

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METAL starts the story of UNIFORM QUALITY

...for all Phillips Screws

And the goal is to make certain that for any given type of screw, the wire used will always meet the same rigid specifications.

To achieve this objective, representatives of metal producing industries are taking part in a sweeping program conducted by the Phillips Recess Engineering Standards Committee.

In this program, manufacturers of Phillips Screws are continually striving to meet the progressive demands of industry . . . constantly working to improve product quality and to keep the Phillips Screw, "The fastener with a plus."

SCREW RESEARCH ASSOCIATION

161 PRESCOTT STREET, BOSTON, MASS.

Use postpaid card. Circle No. 281

USEFUL LITERATURE

To receive your copy of any literature reviewed here, use the postpaid card opposite page 82.

TORQUE CONSIDERATIONS

How to select portable power tool motors, clutches and accessories on the basis of fastener torque requirements is included in 26-page Catalog N.S. 60. Motor and screw torques are charted and various types of clutches described in detail. Lines of air screwdrivers, nut runners and accessories are pictured and specified. Master Power Corp., 13 Krick Rd., Bedford, Ohio.

Use postpaid card. Circle No. 70

THREAD MANUAL

All major threads—American National, Acme, Whitworth, British Association, Metric, Lowenherz and others—are tabled in a 64-page engineering reference manual on screw threads. Valuable for gaging, machining or specifying threads, the booklet has dimensional drawings and formulas for figuring threads and complete data on all the thread series in each type. Mathematical computations are carried out to five places. Jones & Lamson Machine Co., Springfield, Vermont.

Use postpaid card. Circle No. 71

AUTOMATIC FASTENING

Air drills, taps and screwdrivers are combined with a hopper feed and worktable to form an automatic assembly setup. Four-page Form 6038-T describes, specifies and pictures the self-feeding pieces of equipment stocked. Demonstrations offered. The Aro Equipment Corp., Bryan, Ohio.

Use postpaid card. Circle No. 72

AUTOMATIC ASSEMBLY

Automation components and entire assembly machines for use in modern production requirements are pictured, and their special purposes explained clearly, in 46-page Catalog-60. Many models of automatic Geneva motion index tables, dial assembly presses, rivet spinners and special assembly machines, along with tooling and automatic feeds, are shown. Precision Detroit Co., 20100 Sherwood, Detroit 34, Michigan.

Use postpaid card. Circle No. 73

ADHESIVE FILM PREFORMS

Uses and application of dry adhesive film preforms is the topic of a one-page data sheet. The cut-to-size thermosetting adhesive laminations are clean and easy to use. Auburn Mfg. Co., 306 Stack St., Middletown, Conn.

Use postpaid card. Circle No. 74

STOCK NYLON PARTS

Molded nylon parts from stock are pictured and specified in catalog sheets. Washers, bushings, bearings, gears, rollers, glides, etc. are offered. Nylomatic Corp., 112 W. Trenton Ave., Morrisville, Pa.

Use postpaid card. Circle No. 75

COATINGS

Twelve clear urethane coatings are recommended for use wherever varnishes or lacquers have previously been used as finishes or protective coatings. File folder 1-60 has a tabular chart of general, physical, mechanical and chemical properties of four series of coatings. B. B. Chemical Co., 784 Memorial Dr., Cambridge, Mass.

Use postpaid card. Circle No. 76

ENVIRONMENTAL TESTING

The nine main environmental test applications and 13 types of chambers and low temperature freezers are featured in 32-page Brochure 600. Conversion tables on temperature, altitude and humidity are included. Two colored charts present standard atmosphere pressures and properties. Webber Mfg. Co., Inc., Box 217, Indianapolis 6, Ind.

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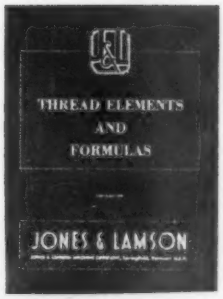
(See 70)

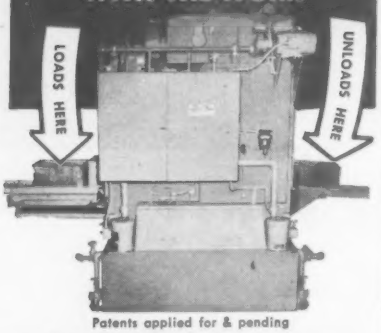


(See 71)

(See 72)

Another Exclusive Industrial Washer That —

CLEANS THE TOTE PAN TOGETHER WITH THE WORK



Patents applied for & pending

DRUM JET Jr.

DESIGNED FOR LIMITED PRODUCTION AND SPACE REQUIREMENTS

Especially created for the smaller producer of screw machine products and other small parts in volume, this compact new Industrial model efficiently washes, rinses and dries work together with accompanying tote pans as inseparable units.

Thanks to exclusive Industrial design and engineering, mixed loads and costly re-sorting are eliminated forever. Tote pans and contents always emerge from washer clean, dry and *intact*.

Revolutionary new model DJ-Jr.:

- PROCESSES 20 to 30 tote pans of work per hour.
- MEASURES only 8'2" long by 5'8" wide — conserves floor space.
- TUMBLES work gently during processing for maximum cleaning and drying action.
- HEATS washing solution and drying air by steam, gas or electricity.
- ADAPTS for complete automation.

Write today for complete details. Or, if you are interested in a machine with higher production (120 tote pans per hour) please request data on model DJ.

INDUSTRIAL SYSTEMS COMPANY

Exclusive Sales Agents for
INDUSTRIAL WASHING MACHINE CORP.
31 Main Street, Matawan, N. J.

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ASSEMBLY LINE STOOLS

Heavy gauge tubular steel constructed stools for assembly lines are described in Catalog 1000. Variations include adjustable legs and backrests and different sizes. Illustrated. Krueger Metal Products Co., 1056 W. Mason St., Green Bay, Wisconsin.

Use postpaid card. Circle No. 78

WRENCHES, PLIERS

Wrenches and pliers for maintenance and assembly are pictured and specified in 16-page Catalog W23. Tools are listed by size, weight per dozen and jaw opening. Diamond Tool and Horseshoe Co., 4712 W. Grand Ave., Duluth, Minn.

Use postpaid card. Circle No. 79

AIR LEAK COST CHART

Just how much compressed air leaks cost is charted in a new hanger card, F-255-A. Costs are compared by area of leak, by diameter in fractions of an inch, cubic feet per month at 75 psi and dollar cost. Punch-Lok Co., 321 N. Justine St., Chicago 3, Ill.

Use postpaid card. Circle No. 80

TECHNICAL RUBBER STAMPS

A complete line of symbols for the electrical, electronic, construction, machinery and other industries have been reproduced on Pedco rubber stamps. A catalog pictures stocked symbols. Special designs are custom drawn. Symbols are ¾" in size. Paper Equipment Distributing Co., Box 90, Price Street Station, New York 12, N.Y.

Use postpaid card. Circle No. 81

AUTOMATIC SCREW SETTER

Screw driving can be done up to 20 feet from the feeding mechanism on the JS-60 Jet Setter. Details on the automatic air driver are told in a two-page mailing piece. Illustrated. Parker-Kalon Div., Clifton, N.J.

Use postpaid card. Circle No. 82

SCREW SLOTTER

Complete details on the features, installation and operation of the Roy screw slotter are given in a 30-page manual. Capacities, tooling, setup, maintenance and trouble-shooting tips are included in text and drawings. Roy Machinery & Sales, Inc., New Britain Ave., Farmington, Conn.

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The Design Equation that Saves You Money...

Use easy-to-install, economical National Retaining Rings to locate and position bearings or parts on pins, shafts and in housings. Eliminate grinding or machining shaft stock to form shoulders. You save time and material and reduce weight and space requirements. Ask for data on your specific application, today!

NATIONAL RETAINING RINGS

= improved design + economy!

ALL TYPES AND FINISHES AVAILABLE—National rings are supplied in square, round and rectangular types of carbon spring steel, bronze, beryllium-copper, stainless steel and aluminum in a wide selection of finishes. Send drawings or sample part for recommendations.

The NATIONAL LOCK WASHER COMPANY
Serving Industry Since 1886
NEWARK 5, NEW JERSEY • MILWAUKEE 2, WISCONSIN

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HOW TO SELECT SPRINGS

"High Temperature Springs," a pamphlet for designers, discusses proper spring selection. Factors such as loss of strength, thermal expansion, deflection, drift and hysteresis are studied. Various types of standard and special springs are illustrated and described. Associated Spring Corp., Bristol, Conn.

Use postpaid card. Circle No. 84

SOCKET WRENCH SETS

Four socket wrench sets for home, farm or factory ranging from 16 to 48 pieces are introduced in a four-page brochure. Sockets, wrenches, extensions are pictured and described. Stevens Walden Inc., 499 Shrewsbury St., Worcester, Mass.

Use postpaid card. Circle No. 85

BRAZING MANUAL

Brazing techniques on all commercial brazeable metals and alloys are covered in a 24-page illustrated manual. Basic functions as heat, flame and torch settings, alloy selection and joint design are detailed. Specific solutions to common problems are answered. All-State Welding Alloys Co., Inc., 249 Ferris Ave., White Plains, N.Y.

Use postpaid card. Circle No. 86

CLAMPS

Six types of clamps for hose, plastic pipe and other industrial applications are pictured and specified in a four-page brochure. Data on minimum and maximum clamp diameters, hose diameters, band and screw lengths are tabulated. Ideal Corp., 435 Liberty Ave., Brooklyn 7, N.Y.

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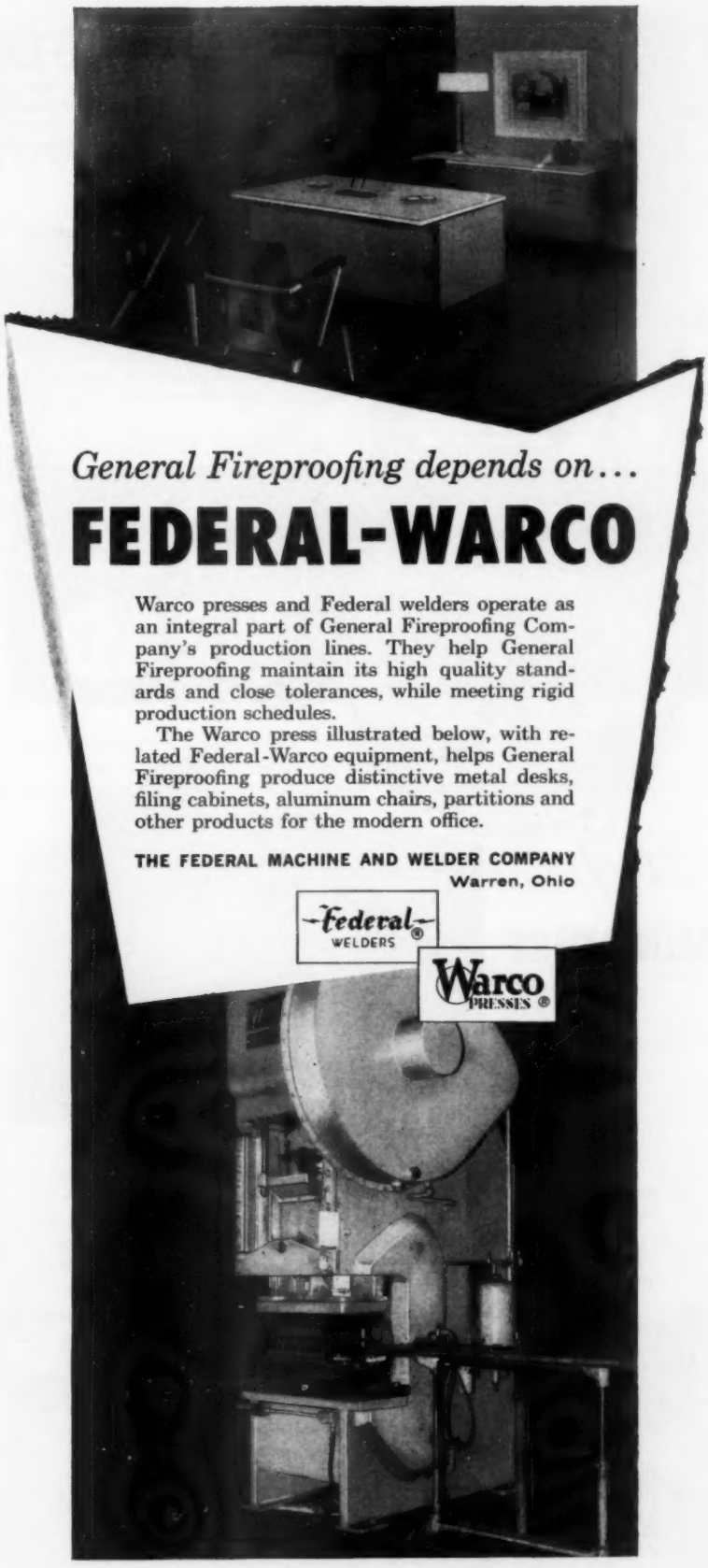
AUTOMATIC SCREWDRIVER

Powasert will automatically drive up to 60 screws per minute, according to details in an eight-page bulletin. Features of the hopper-fed, portable pneumatic unit accompany on-the-job photos and specifications. Similar units are used for nailing and tacking. United Shoe Machinery Corp., 140 Federal St., Boston 7, Mass.

Use postpaid card. Circle No. 88

WIRE MANUAL

How 48 types of wire can be preshaped to a desired cross-section to help reduce user costs and improve product design is included in revised 16-page manual DH-1226A. Helpful charts calculate areas of common shapes and physical properties of steel wire. Tables of standard wire gauges and hardness conversion are given. Page


General Fireproofing depends on...
FEDERAL-WARCO
Warco presses and Federal welders operate as an integral part of General Fireproofing Company's production lines. They help General Fireproofing maintain its high quality standards and close tolerances, while meeting rigid production schedules.
The Warco press illustrated below, with related Federal-Warco equipment, helps General Fireproofing produce distinctive metal desks, filing cabinets, aluminum chairs, partitions and other products for the modern office.
THE FEDERAL MACHINE AND WELDER COMPANY
Warren, Ohio
Federal WELDERS
Warco PRESSES

Use postpaid card. Circle No. 284

Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.

Use postpaid card. Circle No. 89

SPOT WELDING HEAD

Design features and specifications of an electronically-controlled spot welding head are pointed out in technical data sheet No. 2-207. Model M can be used with any welder. Raytheon Co., 1415 Boston-Providence Turnpike, Norwood, Mass.

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ASSEMBLY MACHINE

An indexing machine with as many as 52 programmed actuating control motions permits construction of assembly machines at reasonable cost. This is the thesis of eight-page Bulletin 22-A, introducing Hydra-Cam power units. Features are listed and use in assembly, grinding, drilling machines treated. Illustrated. Earl A. Thompson Mfg. Co., 1300 Hilton Rd., Ferndale, Michigan.

Use postpaid card. Circle No. 91

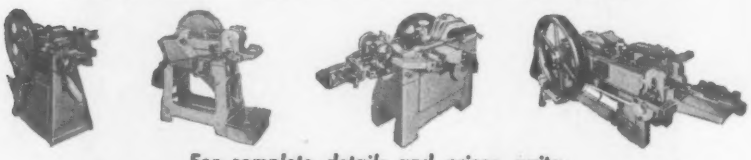
AIR ASSEMBLY EQUIPMENT

Presses, work feeders, indexing tables, impact hammers, cylinders, valves and other equipment operated by air are cataloged in a 56-page booklet. Each tool is dimensionally drawn, pictured and specified. Mead Specialities Co., 549 W. Washington Blvd., Chicago 6, Ill.

Use postpaid card. Circle No. 92

The new Morris-Omega "00" SDDS Cold Header forms parts from wire down to .012" diameter in lengths as short as .016" — and at production rates as high as 150 per minute!

The Model "00" is only one of a series of precision heading machines, which includes a special open die type that will head parts up to 2⅜" in length on wire sizes from .020" to .090".



For complete details and prices, write:

REM SALES INCORPORATED

SUBSIDIARY OF THE ROBERT E. MORRIS COMPANY

5010 FARMINGTON AVENUE • WEST HARTFORD 7, CONN.

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SPRING WASHERS

Eighteen styles of standard spring washers are drawn and specified with popular sizes listed in bold face type. The eight-page catalog No. AS-58 also has dimensional drawings of 18 typical specials which have been designed for specific assembly needs. Shakeproof Division, St. Charles Rd., Elgin, Ill.

Use postpaid card. Circle No. 93

PLASTIC PARTS

Applications for Rulon-A and Teflon are suggested in four-page brochure 9572. Electrical, physical, chemical and mechanical properties are grouped in columns. Basic shapes and typical fabricated parts are pictured. The material can be machined, milled, stamped. Dixon Corp., Bristol 7, R.I.

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WELD NUTS

Samples of weld nuts come with Bulletin 605 which discusses the RN projection weld fastener. Typical applications, stock sizes and specifications and welding setup instructions are included in the six-page mailing piece. The Ohio Nut & Bolt Co., 33 First Ave., Berea, Ohio.

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SELECTING TAPS

Six-page Bulletin 84 includes a chart listing 50 brand-name drill presses with the types of tapping heads (size, style) suitable, spindle taper and bore in tapping head. Lines of tap heads, special quill clamping adapters, holders and accessories are pictured, described and specified. Procunier Safety Chuck Co., 18 S. Clinton St., Chicago 6, Ill.

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IMPACT WRENCHES

No. 777 electric impact wrench and accompanying sockets and bits are introduced in a four-page loose-leaflet. Capacities are listed and typical heavy duty applications pictured. Available in kit form. Millers Falls Co., 57 Wells St., Greenfield, Mass.

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QUICK RELEASE PARTS

Four quick release fasteners—a blind rivet, pin, panel and stressed panel parts—are presented in a four-page brochure. The locking fasteners are shown in large photos and in installation sequence drawings. Deutsch Fastener Corp., 14504 S. Figueroa St., Los Angeles 61, Calif.

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SELF-GRIPPING PLIERS

A line of pliers which can grip when pressure is applied to only one handle is introduced in Form L-45. Thirty-two models are pictured and described, including precision electronic assembly types. Champion DeArment Tool Co., Meadville, Pa.

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RIVETING

Selecting the proper rivet is the topic of one section in 16-page catalog and price list No. 43. Semi-tubular, deep hole, split and special rivets are specified and priced in tabular form. Twenty-six automatic rivet setting machines are pictured and described by capacity. Chicago Rivet & Machine Co., 950 S. 25th Ave., Bellwood, Ill.

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SET SCREW ECONOMICS

The relative economics of set screw installation—by hand, power tool and by automatic inserter—are reviewed in four-page Form 2302. In text and photos the Setomatic unit is shown in horizontal, vertical and 45° angle setups. Standard Pressed Steel Co., Box 1121, Jenkintown, Pa.

Use postpaid card. Circle No. 101

ZINC, NYLON FASTENERS

Latest additions of die cast zinc alloy and molded nylon fasteners are described in bulletin supplement No. 2002-1. Integral washer base parts, wing nuts, cap nuts, open end cap nuts, tamper proof cap nuts are pictured and specified in drawings and charts. Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N.Y.

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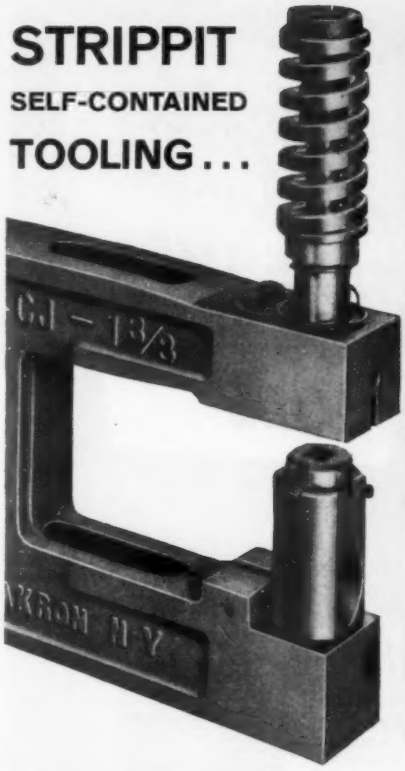
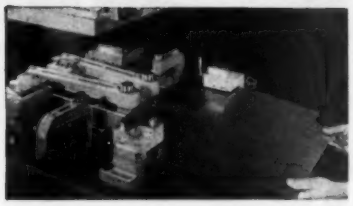
RESINS FOR ADHESIVES

A two-page summary of the properties, uses, compatibility and solubility of resins makes 16-page Form S-79 a useful manual. How the resins are used in compounding rubber and in formulating rubber-based adhesives is discussed. Types, quality of bond, application of these adhesives are present in

STRIPPIT
SELF-CONTAINED
TOOLING . . .



cuts costs 10 ways



1. no expensive custom dies—save all the time and cost involved in designing and building custom, single-purpose dies.

2. lower labor costs—no high-salaried tool and die makers are needed. Any good bench man can set up Strippit Tooling.

3. minimum tool investment—Strippit units can be kept in continuous use. You have no heavy investment in idle dies—no die storage problem.

4. shorter lead time—as soon as the pattern is ok'd, Strippit Tooling can be set up and put into production *immediately*.

5. faster, more accurate setups—Strippit units are self-contained, self-stripping and permanently aligned—bench-assembled on drilled templates, T-slotted plates or bed rails. Nothing is attached to the press ram. No need for die spotting and setting.

6. press downtime cut—as each run is completed a new Strippit setup is already waiting for the press. Self-contained design permits punch replacement in the press. Downtime is kept to a minimum.

7. unlimited versatility—Strippit units can be set up in any hole pattern and used over and over again—for long press runs or quick-change pilot runs—in stamping presses or press brakes.

8. a complete line from a single source—punching units with standard or special tooling, for punching up to ¾" mild steel—standard and special notching units for work up to ¼" mild steel.

9. nationwide sales and service—by trained tooling methods engineers in all major industrial areas. Manufacturing plants in Akron, N.Y., Los Angeles, Calif.; warehouse in Chicago, Ill.

10. specify "Strippit"—the original system of self-contained tooling. There are imitations but no substitute for Strippit engineering know-how, tested and proved designs and materials, first-class workmanship and the other advantages of doing business with a reputable organization that has been in business for 35 years.

FOR COMPLETE INFORMATION—write for the new Strippit General Catalog.

WALES **STRIPPIT** INC.

241 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario

A UNIT OF HOUDAILLE INDUSTRIES, INC.

Use postpaid card. Circle No. 286

Airflex® Riveters bring an entirely new technique to the field of fastening. Riveting now becomes feasible under conditions that previously made it impractical.

Wherever tolerances or riveting pressures are critical, or assemblies and materials are apt to distort or fracture, the Airflex® *cold-flow* principle has provided the solution. Selective tolerances as close as .002" between peened end of the rivet and the material are being maintained even on volume production. Materials impose no limitations—glass, ceramics and plastics can also be riveted economically. Capacity for steel rivets range from 3/32" to 1". Silver, aluminum, brass, copper, titanium rivets also—hollow or solid—from 1/16".

Airflex® Riveters can give you faster, better riveting on routine jobs—and the economy of riveting on the "impossible" jobs. Write now for complete information.

AIRFLEX® PRINCIPLE combines high frequency blows with a spinning action to *cold-flow* the rivet. Force and rate of impacts, duration of impacts and spinning speed are independently controlled. Operator training is cut to a minimum.

LEMERT ENGINEERING CO., INC.
191 E. JEFFERSON ST., PLYMOUTH, IND.

Airflex®
RIVETERS DIMPLERS

Use postpaid card. Circle No. 287

tabular form. Schenectady Varnish Co., Inc., 3303 Congress St., Schenectady 1, New York.

Use postpaid card. Circle No. 103

PARTS CLEANING MACHINE

Vibra-Washer units automatically clean or process ferrous or non-ferrous machinings, stampings and small castings. The vibrating assembly, two possible conveyor types and other components are individually described in six-page Bulletin 107. Simplicity Engineering Co., Durand, Mich.

Use postpaid card. Circle No. 104

O-RINGS

Design data on Toruseal O-rings is contained in a 12-page engineering manual. Compressive force tests are charted, adaptability to various flange grooves supplement pages of specification and installation tables. The D.S.D. Mfg. Co., 2964 Whitney Ave., Hamden, Connecticut.

Use postpaid card. Circle No. 105

WIRE SOLDER DISPENSER

Kormat, a small hand tool with a probe tip, dispenses wire solder sizes from .028" to .074" to speed assembly. The tool is introduced in a one-sheet flyer with in-use photo, drawing and price. Products for Industry, 220 S. Rose St., Los Angeles 54, Calif.

Use postpaid card. Circle No. 106

Representatives Wanted

Excellent commissions. Prefer men allied with fastener industry.

Write

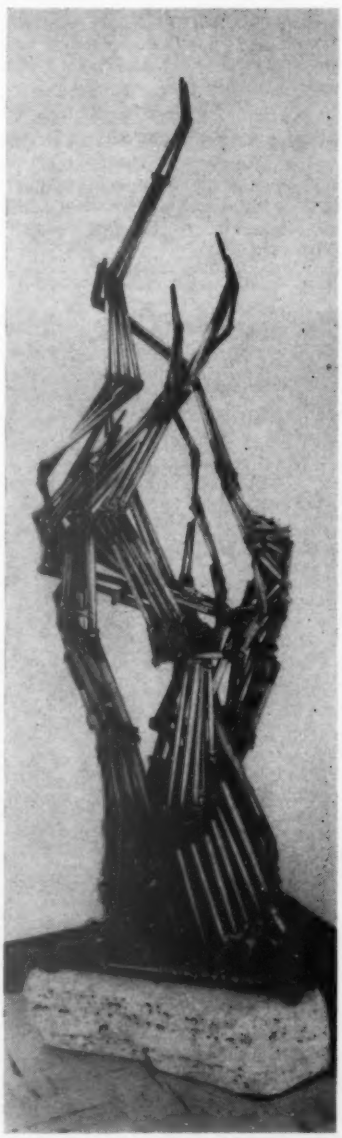
T. N. F. Corp
Box 132, Linden, N.J.

for full details

Use postpaid card. Write in No. 311

INDUSTRY MAKES NEWS

Given free rein to his imagination, Prof. Egon Weiner created this nuts and bolts abstraction from the Biblical story of Moses and the burning bush. He calls it the "Burning Bush of Industry."



WEINER CREATES FROM NUTS AND BOLTS

An abstraction in metal based on the account of the burning bush in the Bible, and designed by Prof. Egon Weiner, is now on display in the lobby of Heads and Threads Inc., a Chicago distributor.

The six foot high work uses only nuts and bolts welded together in flame-like arrangement.

Weiner, professor in sculpture and life drawing at the Art Institute of Chicago, says: "Since bolts and nuts are the main support of our modern industry, I took the Biblical title of the ever active burning bush as a symbol for the always active industry fed by these small but vital elements." The artist's works have received many awards, including the Grand Prix, Paris.

THERE'LL BE A LOT OF FASTENERS HERE!

Portugal has approved a provisional award for the construction of the Tagus River Bridge to the United States Steel Export Company of N.Y.

The design of the largest suspension bridge in Europe and fifth in the world was prepared by D. B. Steinman. Fabrication of the principal structure will be by American Bridge Division of U.S. Steel; and construction of the main bridge pliers will be by Morrison Knudsen. Approximately 41,000 tons of fabricated steelwork will be required.

The main towers will be spaced 3320 ft. apart, rising 755 ft. above solid rock foundations requiring excavations to record depth. The clearance will be 238 ft. over mean tide. Including approach viaducts, length will be 1.9 miles.

ELECTRONICS EXPERTS AT AIEE SYMPOSIUM

Sixteen experts in the field of electronic equipment will deliver papers at the Ninth Annual National Symposium on Industrial Instrumentation sponsored jointly by the American Institute of Electrical Engineers and the Institute of Radio Engineers, Professional Group Industrial Electronics. The Symposium will be held September 21 and 22, 1960 at the Manger Hotel, Cleveland, Ohio.

The last session on Sept. 22, 2:00 to 5:00 p.m. has as its theme Process Control and Techniques. This

continued

session will hear, among others, J. S. Cellatly and R. Spillar, Western Electric Co., Inc., Chicago, describe a **"High Speed Welder For Crossbar Switch Contacts".**

HI-SHEAR CHANGES COMPANY NAME

Hi-Shear Corporation, Torrance, Calif., is the new name for the former Hi-Shear Rivet Tool Co. President George S. Wing announced that the name change better portrays the expanding line of the company's proprietary products and diversified industrial interests. There will be no change in management or ownership.

KAYNAR, ESNA CROSS-LICENSE FASTENERS

A cross-licensing agreement on 12-point hex nuts for use in the airframe industry has been agreed upon by Kaynar Mfg. Co., Inc., of Los Angeles, and Elastic Stop Nut Corporation of America, of Union New Jersey, and the latter's West Coast subsidiary, Collins-Powell Co. This agreement is an amicable termination of patent litigation between the two companies.

By the licensing arrangement, Kaynar has granted ESNA a license to manufacture the Kaylock-type locknut, while Kaynar is granted a license to manufacture the Erb locknut.

HARTWELL ELECTED PRESIDENT OF VELCRO

Clark Hartwell, president of Hartwell Corp., Los Angeles, has also been elected president of Velcro Corp., New York City, and vice president of Velok Ltd., Montreal.

Hartwell replaces Ralph B. Hood as president of Velcro, although Hood retains the presidency of Velok Ltd. and American Velcro Inc.

SIMON S. KAHN, vice president of the Parker-Kalon Division, General American Transportation Corporation of Clifton, N.J., departed from New York International Airport via El Al Israel Airlines jet-powered Britannia for London to begin a five week business trip that will also take him to six European nations.

BRISTOL MOVES NEW JERSEY OFFICE

The Bristol Company's New Jersey branch office has moved from Newark to Springfield, New Jersey. J. F. Peterson is the branch manager.

FASTENER SHIPMENTS UP IN JUNE

June shipments of industrial fasteners rose to 94% of the 1956-58 average, the first upswing in three months. The seasonally adjusted mark of 94 (unadjusted, 98) was released by the Industrial Fasteners Institute.

The mark compares with the June 1959 figure of 129, unusually heavy in anticipation of the steel strike. In successive months this year the figure has been 102, 111, 103, 92, 92, 94. The 1959 year average was 101.

GRIES ADDS OEM NORTH CENTRAL SALESMAN

Gries Reproducer Corporation, New Rochelle, N.Y., has appointed R. E. Anderson, Minneapolis, Minn., exclusive GRC sales representative to the original equipment market in Minnesota, North and South Dakota, and western Wisconsin.

... no nuts can be better than the Standards set for . . manufacture
. . along with six other basic quality controls
inspection at the various stages of production
Manufacturers of Standard and Special ferrous and non-ferrous Hexagon, Square and "12 Pointer" nuts . . . "Conelok", "Huglock" and "Marsden" locknuts . . . Send for 12-page condensus-brochure that includes complete specifications and engineering data, sizes ⅜" to 4¼" cross flats . . .
NMP
NATIONAL MACHINE PRODUCTS COMPANY
an sps company 44250 UTICA ROAD UTICA, MICHIGAN

THREE ASME CONFERENCES IN OCTOBER

The American Society of Mechanical Engineers will help sponsor three conferences in October: Rubber and Plastics, Oct. 9-12, Erie, Pa.; Fuels, Oct. 10-11, Charleston, W. Va.; Lubrication, Oct. 17-19, Boston, Mass.

PHEOLL ACQUIRES PROGRESSIVE MFG.

Pheoll Mfg. Co., Inc., Chicago announced the acquisition of Progressive Mfg. Co., Torrington, Conn., a division of The Torrington Company.

According to Robert P. Lord, president of Pheoll, this will substantially increase the sales and production capacity of the company's industrial fastener business. The acquisition was for an undisclosed cash sum with no stock involved.

Progressive will operate as a division of Pheoll of New England, Inc., under the direction of Stanley C. Adamek, general manager of all Pheoll operations.

The Progressive plant, containing 150,000 sq. ft., now employs over 100 people. The Pheoll Chicago plant occupies more than 300,000 sq. ft. and employs over 900.

SKOOG JOINS REMINGTON RAND SYSTEM

Donald K. Skoog has been appointed to the newly created position of director of engineering, Remington Rand System-Photo Records Division of Sperry Rand Corporation.

Prior to joining the company, Mr. Skoog was for six years director of research for the Thor Power Tool Company, Aurora, Ill. He has also held responsible engineering positions with Armour Research Foundations, Hughes Aircraft Company and the Lockheed Aircraft Corporation.

HARPER REPORTS RECORD 6 MOS. SALES

The H. M. Harper Company, Morton Grove, Ill., reported the highest sales in the company's 37-year history for the six months ended June 30, 1960.

H. M. Harper, president, said that sales for the period totalled $6,536,396, a 15% increase over sales of $5,634,333 reported a year ago.

Net earnings after taxes amounted to $419,376 and were equivalent to 81 cents per share on the 486,460 shares of common stock outstanding. Last year's earnings for six months were $429,380 and were equal to 83 cents per share.

NAT'L MACHINE SKIRTS RUST PROBLEMS

Rust continues to be a big problem in the production and use of fasteners. Engineers at National Machine Products Co., Utica, Michigan, have put in a complete Ransohoff installation of automatic rust-inhibiting equipment to lick this problem.

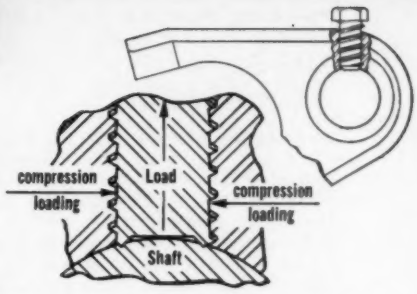
The new equipment is capable of washing, rinsing, rust-proofing and drying more than 100 tons of nuts a day. The entire process is automatically sequenced and timed to perform a total of ten operations, including loading and unloading.

The machine is equipped with three large centrifugal packless pumps for delivering washing, rinsing, and rust-proofing solutions. Tanks are heated by thermostatically controlled gas burners. A separate heating system provides 4300 cfm of drying air.

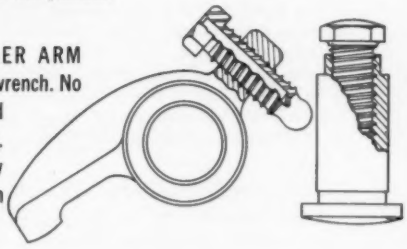
continued

Circle No. 288 Circle No. 289 →

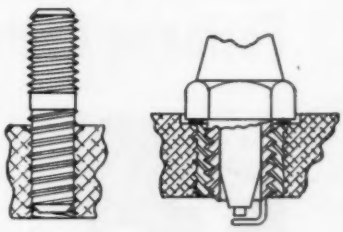
Millions of "LOK-THREAD" fasteners have been used many years by largest automotive, aircraft, appliance and other manufacturers.



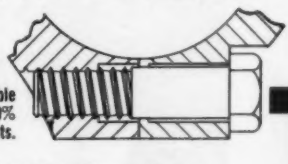
SET SCREW, illustrated, shows how stronger "Lok-Thred" fasteners grip firmly on the 6° locking root. Vibration and work load improve the lock by wedging action. They assemble with holes tapped within standard limits. They cannot cock or wander. Ideal for fastening in light metals and plastics.



"LOK-THRED" ROCKER ARM SCREWS require only one wrench. No lock nuts used. One hand free for checking clearance. Speeds valve lashing. Now used in steel, cast iron and aluminum.



STUDS can be simply used in any class of tapped hole. The coarse LT stud end is stronger than UN-F nut end. INSERTS for cap screws and spark plugs. Tests prove no change in heat range. Used extensively for salvaging expensive parts.



CON-ROD SCREWS provide desired permanent strain (no fretting) with savings of many ounces of reciprocating mass. The dowel-like fit and perfect adaptability have proved ideal during many years of trouble-free service.

All "Lok-Thred" parts are fully interchangeable with conventional threaded parts—40 to 100% gain in tension, torsion and endurance limits.

Here is a partial list of "Lok-Thread" suppliers:

AMERICAN STANDARD PRODUCTS, INC.
3030 Main St., Hartford, Conn.

FERRY CAP & SET SCREW CO.
2151 Scranton Road, Cleveland 13, Ohio

THE LAMSON & SESSIONS CO.
5000 Tiedeman Road, Cleveland 9, Ohio

THE NATIONAL SCREW & MANUFACTURING CO.
2440 E. 75th St., Cleveland 4, Ohio

MAYNARD MANUFACTURING CO.
22755 Shakespeare, E. Detroit, Mich.

CLAUDE SINTZ, INC.
1928 Stanley, Detroit 8, Mich.

STANDARD PRESSED STEEL CO.
Jenkintown, Pa.

UNIVERSAL DIESEL PRODUCTS, INC.
Sturgis, Michigan

LOCK THREAD CORPORATION, 2832 E. Grand Blvd., Detroit 11, Mich.

Work is automatically loaded into the Ransomatic by an independently powered conveyor. After rust-proofing and drying, the finished fastening products are unloaded by the machine, directly into shipping containers.

MASTER POWER NAMES GENERAL SLS. MGR.

Thomas J. Bennett has been appointed general sales manager of Master Power Corp., Bedford, Ohio. His former position of central district manager, Cleveland, will be filled by Edgar D. McIntosh, previously in the Indianapolis sales office. Bennett joined the company in 1952 in charge of branch functions in Toronto.

PANDUIT PURCHASES LAND FOR EXPANSION

Panduit Corp., Midlothian, Ill., has purchased 235,000 sq. ft. of land in Tinley Park, Ill., and expects to improve the property with a $250,000 building to expand in the plastic electric component business.

SPS ADDS SIX TO SALES STAFF

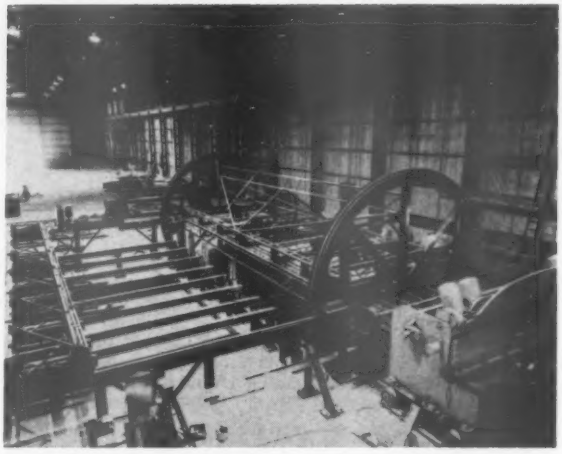
Six men have been added to the fastener products sales staff of Standard Pressed Steel Co., Jenkintown, Pa.

Richard Gormely (Boston) and Paul Campion (Hartford) have been assigned in the New England territory. In the Midwest, Richard Kress will be based in Minneapolis and Steven Mahoney in Birmingham, Mich.

On the West Coast, William Gennoy and Ralph Pucci will work out of Los Angeles.

SYNFLEX APPOINTS FIVE DISTRIBUTORS

The Synflex Products Division of Samuel Moore & Co., Mantua, Ohio has appointed the following authorized master distributors: Hope Rubber Co., Fitchburg, Mass.; F. B. Wright Co., Dearborn, Mich.; Shively Brothers, Inc., Flint, Mich.; and Kent Rubber Supply Co., Grand Rapids, Mich. Continental Air Equipment, Brooklyn, has been appointed an authorized stocking distributor.



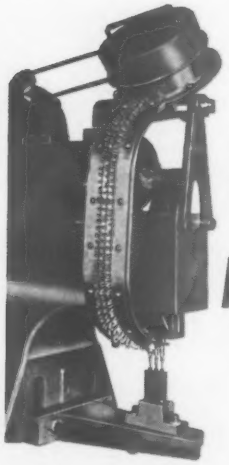
KEYSTONE GETS GIANT WIRE FABRIC WELDER

A 191-foot long automatic wire fabric welding machine, delivered recently to Keystone Steel & Wire Co., Peoria, Ill., by National Electric Welding Machines Co., is capable of producing wire mesh at the rate of 60 tons a day, in widths and patterns for a number of applications ranging from light fencing to heavy duty highway mats.

Reported to be the largest machine of its type ever built, the unit will turn out mesh up to 17 feet wide—the widest ever produced in the U.S.

The welder joins wire from ⅛ to ½" diameter. It employs 80 electrodes for the work, the power being supplied by 40 transformers, each of 40 kva linked in series. The machine operates at a speed of 45 strokes per minute.

Fastening Costs Too High?



SET MULTIPLE EYELETS AUTOMATICALLY

ON MACHINES BY Edward Segal

You can do many fastening operations faster and more economically on Edward Segal Automatic Eyeleting Machines. Faster because a number of eyelets can be set simultaneously and rapidly. More economically because of the low cost of eyelets. And Segal machines are designed to give dependable, neat fastenings every time.

Let us study your fastening problem. We can supply equipment with just the right tooling and degree of automation for your operation. Write for details to section AFE-9

EDWARD SEGAL • 132 LAFAYETTE STREET, NEW YORK 13, N. Y.
MFRS. OF EYELETING MACHINERY, SPECIAL HOPPERS & FEEDING DEVICES

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BEHR

FASTENER AND WIRE FORMING EQUIPMENT

complete plant layouts or departments

BEHR MACHINERY & EQUIPMENT CORP.
1210 Seminary St.
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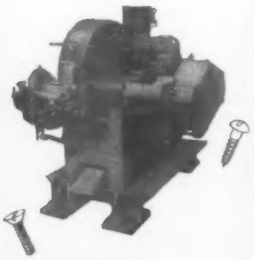

COLD HEADERS
THREADING MACHINES
WIRE DRAWING MACHINES
WIRE STRAIGHTENING UNITS
SPRING MAKING MACHINES
WIRE CUTTING MACHINES
NAIL MAKING MACHINES
BARBED WIRE MACHINES

WRITE FOR CATALOGS!

Also — a complete stock of new and used Machine Tools and other equipment.

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HULTGREN BECOMES RHODE ISLAND SPRING

Rhode Island Spring Products, Inc. of Providence, R.I., is the new name of O. W. Hultgren Mfg. Co. All product lines of the Hultgren organization will be continued. Projected plans include expansion and modernization of production facilities.

Paul J. D. Paltzer, for eight years manager of O. W. Hultgren, has been appointed vice president and general manager of Rhode Island Spring Products.

BOWMAN PRODUCTS DECLARES DIVIDEND

Bowman Products Company, Cleveland, declared a $.22 per share dividend payable July 29th to stockholders of record July 15th. Bowman common closed yesterday at 20½.

A three-man executive committee has been appointed: C. F. Devine, president and committee chairman; D. L. Thoburn, first vice president; and P. V. Thoburn, treasurer. This committee is charged with responsibility for the company's over-all operations.

B-O-P NEW ASSEMBLY DIV. MANAGER

Appointment of Kenneth N. Scott as general manager of the Buick-Oldsmobile-Pontiac Assembly Division was announced by John F. Gordon, president of General Motors. Scott will succeed James L. Conlon, who is retiring under the General Motors retirement program.

DEFENSE DEPT. CONFERS ON FASTENER STDS.

A Department of Defense Committee took part in a meeting hosted by the Screw Research Association July 28-30 in Massachusetts. The group, which included leaders of the fastener industry as well as Defense personnel, discussed policy and practices on standardization of fasteners, design requirements, and coordination of standards.

continued

1-PART NO-MIX EPOXY ADHESIVE

speeds production bonding

If you can heat-cure at 300°F (or higher) this unique *one-part*, 100%-solids epoxy paste adhesive —BONDMASTER M620—can:

- give you high-strength bonds with all metals, all plastics;
- eliminate costly post-finishing (won't flow or drip during cure!);
- let you use unskilled labor on critical bonding jobs;
- eliminate time-consuming weighing and mixing of separate components.

USE RIGHT FROM SHIPPING CONTAINER

Spreads as easily as a heavy cold cream just as you receive it. Thixotropic, too—won't flow or drip; excellent void-filler.

Write for detailed Data Sheets and Technical Article reprints.

RUBBER & ASBESTOS CORP.
224 BELLEVILLE AVE., BLOOMFIELD, N. J.

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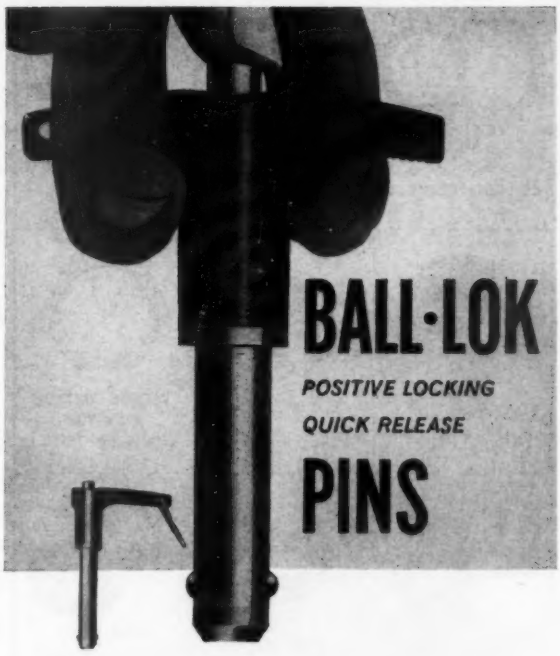

FAST...SAFE...DEPENDABLE

Available in both single acting and double acting styles.

The ideal fastener for applications where parts or assemblies are frequently assembled or disassembled for service or replacement. Also BALL-LOK PINS are widely used as a safety fastener to prevent accidental or premature release of movable assemblies.

For every design requirement where a pin fastener must be easy to insert...quick to withdraw, yet provide positive safety BALL-LOK single acting pins serve best. Five head styles adapt to all design requirements. Pins range from 3/16" (#10) to 1" diameter.

POSITIVE RELEASE UNDER "OVERLOAD" OR "BOUND" CONDITIONS

Double acting BALL-LOK Quick Release Pins combine rugged strength with instant insertion, easy withdrawal and self safetying. In cases where ordinary fasteners may bind in misaligned holes or under heavy loads the added "drive-in" "drive-out" spindle permits forcible release of the pin. Double acting pins are available in "Ring," "T" and "L" head styles. Use the experienced technical knowledge of our engineering staff to help solve your quick release fastener problems.

FOR TECHNICAL DATA — WRITE FOR BROCHURE AV-460

AVDEL, Inc. is the new corporate name for the combined facilities of Aviation Developments, Inc. and D. W. Price Corp., leading manufacturers of quick release pins.

AVDEL INC.
210 SOUTH VICTORY BOULEVARD • BURBANK, CALIFORNIA

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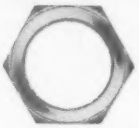
CONDUIT LOCKNUTS
— Up to 6"

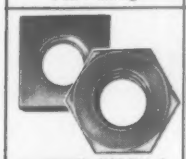
LOCKNUTS
Reversible — One Piece

SPRING-NUTS

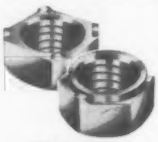
J-LOK
Reversible with
Delrin Insert
Pat. Pending

STOP-NUTS


VOLUME-CONTROL
& SWITCH
MOUNTING NUTS


MACHINE SCREW &
FINISHED NUTS

WING NUTS


WELD NUTS
Square & Hexagon

Available in Stainless Steel, Brass,
Aluminum and Steel

JACOBSON NUT MFG. CORP. Kenilworth, New Jersey

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Martin F. Connolly of the Headquarters of Air Materiel Command was the chairman. Lou Cummaro, vice president of Phillips Screw Company, represented the Screw Research Association. The meeting was another step in the far-flung program designed to assure uniform standards in the fastener industry.

CLECO APPOINTS BOSTON SALESMAN

Paul McKim Mitchell has been named Boston representative for Cleco Air Tools, Houston, Texas. Mitchell will service Boston and surrounding area.

For the 20 years prior to joining Cleco, he was associated with the Reed Rolled Thread Die Co., serving as methods engineer and most recently as sales engineer.

BLACK & DECKER REALIGNS MANAGEMENT

Black & Decker Mfg. Co., Towson, Md., has re-elected Robert D. Black chairman of the board. However, Alonzo G. Decker, executive vice president, will succeed Black as president. W. Griffin Morrell, a director of the company, has been named executive vice president. He resigned from The Chesapeake and Potomac Telephone Co.

H. M. HARPER OPENS MONTREAL BRANCH

Harper Everlasting Fastenings, Ltd., Toronto, a subsidiary of The H. M. Harper Co., Morton Grove, Ill., has opened a new branch office in Montreal.

The company also announced the appointment of Russell D. Brown as district manager of the Eastern Provinces of Canada.

A native Canadian who served in the Toronto Scottish Regiment, Brown has been a resident of Montreal for the past 14 years.

MOLLY®

JACK NUT

The Only
Blind Fastener
Which Grips Any Material
From 0" To 3/8" Thick

The Jack Nut cuts cost, speeds assembly, solves hitherto impossible fastening problems. Can be used as a rivet and/or blind fastener. It's versatile, easy to use and no special tools are needed.

The only blind fastener with threads which grips any material from 0" to 3/8" thick. Needs only 1/8" expansion space. Allows holes to be fashioned before, during or after fabrication. Hole size is not critical and special type of hole is not necessary.

Made of quality steel, cadmium-plated. Grips evenly on rough as well as smooth surfaces. Provides vibration-proof assembly. Weight-carrying capacity is limited in most cases only by strength of the material in which used.

Sold By Wholesale Hardware, Electrical Wholesale & Industrial Supply Distributors

MOLLY® CORP.
2301 N. 5th St., Reading, Pa.

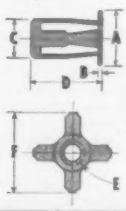
EASY TO INSTALL

1 Insert Jack Nut into hole. Needs only 3/8" expansion space.

2 Run in screw to collapse spider anchor backing by exerting pull on thread.

3 Jack Nut now is installed and ready to receive attachment screw.

SPECIFICATIONS



CAT. NO.	A CAP DIA.	B CAP THICK.	C BODY DIA.	D O'ALL L'GTH.	E THREAD	F MAX. SPREAD
4-S, JN	15/32	3/64	9/32	9/16	6-32	43/64
4-L, JN	15/32	3/64	9/32	3/4	6-32	43/64
* 6-S, JN	17/32	1/16	3/8	11/16	10-24	25/32
** 8-S, JN	5/8	1/16	27/64	3/4	1/4"-20	13/16

S for 0" to 3/16"; L for 3/16" to 3/8"
*8-32 & 10-32 threads available
**10-24 & 12-24 threads available
NOTE: 4-S, JN & 6-S, JN also available in brass

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HIGH SPEED equipment for better production, lower cost

RIVETING HAMMERS

Available in 10 sizes. Handle full range of work up to 2" diameter solid rivets. Quick to set up or change tools. Available in bench and pedestal models. Backed by finest, most complete tooling service in the industry.

NOISELESS RIVET SPINNERS

Motor-driven, noiseless, rugged. Spindle travel adjustable. Fast cycle. Produces absolutely uniform assemblies. Model E (capacity 1/8") and Model G (capacity 5/16") available in both bench and pedestal models, foot or AIR operated.

ELECTRIC SOLENOID PUNCH

Stakes, rivets, marks, cuts off, bends, crimps, etc. with positive alignment. 4 1/2" maximum vertical opening (2 3/4" minimum for tools and work). 1 3/4" spindle travel, adjustable downward. Fast cycle. 3500-lb. impact. Single or dual, hand or foot control.

AUTOMATIC STAKING MACHINES

Pressure pad built into spindle firmly secures work before blow. Allows for variation in thickness. Delivers uniform blow every time. Quick, easy adjustment, wide power range. 4 sizes—bench and pedestal models, feet and air operated.

We manufacture the most COMPLETE LINE of assembly machinery on the market today, so generally can recommend the CORRECT TYPE MACHINE for any assembly application.

FREE Assembly Engineering Service

Just send samples or blueprints of parts to be assembled. We'll recommend the right tools, procedure and equipment to use . . . without cost or obligation.

HIGH SPEED HAMMER CO.

308 NORTON ST., ROCHESTER 21, N.Y.

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R. D. THOMAS, JR. ELECTED AWS PRES.

THOMAS, JR.

R. David Thomas, Jr., has been installed as president of the American Welding Society. The president of Arcos Corp., Philadelphia, is a registered professional engineer (Pa.) and a 1939 graduate of Cornell University with a Master's degree in Chemical Engineering. He was previously first vice-president of AWS and honored in 1956 for meritorious service to the industry.

His father, Royal D. Thomas, Sr., chairman of the board of Arcos died May 28 in Tokyo, Japan, while on a tour of the Far East. Thomas was named an honorary member of the AWS in its 41st Annual Meeting in April.

RB&W NAMES TWO TO MIDWEST SALES POSTS

John R. Metzger and Howard A. Collins have been named to new sales posts with Russell, Burdsall & Ward Bolt and Nut Company.

Metzger, who has served at the Rock Falls, Ill., plant and since 1949 as office manager in the Chicago sales office, returns to Rock Falls as sales supervisor at that plant. Collins joins the Chicago sales office of RB&W after 24 years with Buffalo Bolt Co., North Tonawanda, N.Y., in accounting and sales capacities.

FEDERAL, MCKAY TO EXCHANGE SHARES

The McKay Machine Co. of Youngstown and The Federal Machine and Welder Co. of Warren, Ohio, issued a joint statement whereby McKay proposes to offer to Federal stockholders an exchange of one share of McKay common stock for 19 shares of Federal common stock.

The companies have a combined work force of more than 1100 employees, including an engineering staff of about 150, and approximately 300,000 square feet of manufacturing area.

continued

SPECIAL RIVETS
like some of the samples shown here . . . or the more commonly used tubular and split rivets . . . they're all alike to the American Rivet Co. And always—our own special brand of quality and service that gets you what you want when you want it.
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Write for price list. For specials, send specifications for prices.
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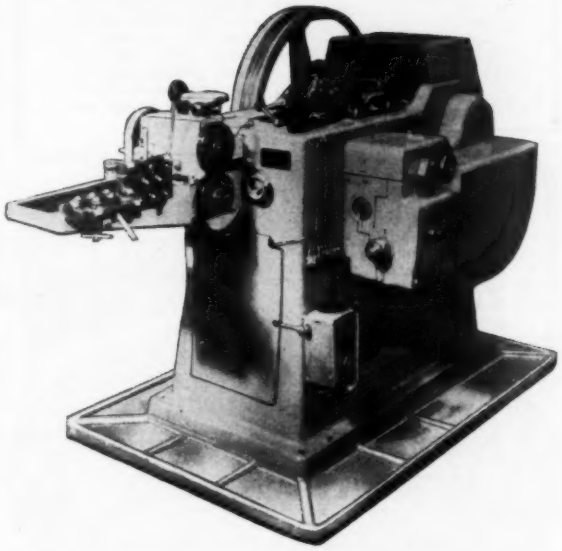
Single and Double Blow

COLD HEADERS



These famous German machines feature:

- ★ CAPACITIES—3/16" to 1" dia. wire stock: Short Stroke—1" to 4-15/16" shaft length; Long Stroke—1-3/4" to 8"
- ★ Fitted with solid or open dies
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- ★ WEAR PLATES ARE ADJUSTABLE nitraded steel
- ★ AUTOMATIC LUBRICATING SYSTEM—to all parts of machine
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- ★ A complete range of auxiliary equipment such as re-heading machines, trimmers, pointers, slotters and thread rollers are available

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The BOLTMASTER Co.

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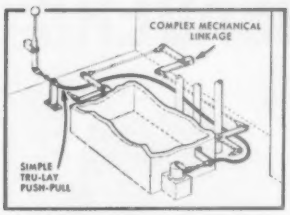
TRU-LAY PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY AND IMPROVE DESIGN



Push-Pull remote controls, shown here, are flexible, have but one moving part, and give a lifetime of accuracy. Mechanical linkages are complex, are made of many parts, wear at many points, and produce increased backlash, lost accuracy, and vibration rattles.

This Push-Pull Data File—containing 7 engineering bulletins—will show you how these flexible controls have eliminated mechanical linkages on hundreds of products. You can make *your* products more useful, easier to sell, with Push-Pull controls. Write for your Data File today.

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AMERICAN CHAIN & CABLE

ACCO

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6800-D East Acco Street, Los Angeles 22
929-D Connecticut Ave., Bridgeport 2, Conn.

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McKay sales, excluding those of subsidiary and affiliated companies, were $9,822,571 for the year ended December 31, 1959, and $5,664,030.00 for the five months ended May 31, 1960. Federal sales, excluding its affiliate, were $4,709,394.00 for the fiscal year ended September 30, 1959, and $5,471,750.00 for the eight months ended May 31, 1960.

VEET INDUSTRIES ACQUIRES SOURANT

Veet Industries, Detroit, Mich. has acquired the Sourant Mfg. Co., Bellville, Mich., manufacturer of welding guns, automation machines, cylinders and pumps. This brings to 10 the number of manufacturing divisions of Veet.

DETROIT STAMPING EXECUTIVE DIES

William H. Roberts, executive vice president of Detroit Stamping Company, died suddenly June 21 in Harper Hospital at the age of 42.

He was part of a Detroit family which at one time owned and operated the large Roberts Brass Company plant. His father, William Herbert Roberts, founded Detroit Stamping.

Until moving up as executive vice president, the entire marketing of these plants was directly under his supervision.

SALES STAFF CHANGES AT TRIPLEX SCREW

Triplex Screw Co., Cleveland, Ohio, has announced the following appointments and changes in its sales staff: John H. Van Moss, Sr., railroad sales; W. Rezek, northern Illinois; W. McMaster, North and South Carolina; H. R. Garner, southern Ohio, Kentucky, southern Indiana; R. R. Cooney, western Pennsylvania; L. Dregalla, eastern New York; K. Nickerson, New Hampshire, Maine, Vermont; Tommy Tucker Co., Mississippi; J. K. Kessler Assoc., Florida; J. M. Zent, northern Indiana; J. C. Maertens, Michigan, except Detroit.

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- THE HIGHER THE LOADS, THE GREATER THE MARGIN OF SUPERIORITY OF MOLYKOTE G

Write for your free sample of MOLYKOTE G LUBRICANT today. We will also send you a copy of our new Bulletin 126 which gives complete details. THE ALPHA-MOLYKOTE CORPORATION, 65 Harvard Avenue, Stamford, Conn. Phone Fireside 8-3720. Plants in Stamford, Conn., Munich, Germany and Strasbourg, France.

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COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

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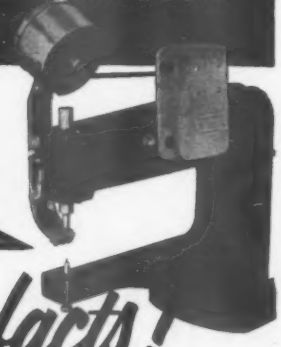
EYELETTING

EXCLUSIVE
SIMPLIFIED EYELET-RELEASE



Get the facts!

on the New Low Cost ETCO AE-100

This new foot-operated (or fully automatic air-operated) machine has a jam-proof, electrically driven feed. The belt driven agitator, built into the hopper, automatically feeds the eyelets to the track and down to the work position, enabling the operator to work at his fastest speed. Exclusive, simplified, foolproof, eyelet-release prevents waste of eyelets.

The generous 11" throat depth and high overhanging arm provide excellent visibility and permit easy handling of large pieces. Interchangeable tracks accept all standard make eyelets and sizes. Send for complete information.

for Printed Circuits, Component Assemblies, Cloth & Leather Assemblies

EYELET TOOL COMPANY, INC.
236A BROADWAY
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"THE MOST ORIGINAL DISPLAY in the American Exhibit," was the rating given Whirlpool's Miracle Kitchen by the Poznan, Poland newspaper. It was at the International Trade Fair here that Deputy Assistant Secretary of Commerce, W. A. Edwards, above left, encouraged Polish-American commercial relations. He is being introduced by U.S. Ambassador to Poland, Jacob Beam. The kitchen will next be on display at the fair in Zagreb, Yugoslavia, Sept. 1-25.

CENTRAL SCREW NAMES WESTERN AGENT

Announcement was made recently by Central Screw Company, Chicago, Illinois, of the appointment of C. W. Stone Company, Salt Lake City, Utah, as their representative in the states of Utah, Wyoming, Colorado, Montana and Idaho.

FASTENER SPECIALIST JOINS MFG. REP.

E. J. (Gene) Wolfrom, a veteran of 27 years of fastener application experience, has joined Southwestern Agencies, Los Angeles, Calif.

ANTI-CORROSIVE PROMOTES PARKER

Mayland L. Parker has been appointed general sales manager of Anti-Corrosive Metal Products Co., Inc., Castleon-Hudson, N.Y.

continued

For Stud Setting and Pulling

and

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"Titantorker" Controlled Torque Driver

For variety of torque uses. Audible signal when desired torque is reached. Easy adjustment. Four sizes: maximum torques from 75" lb. to 225' lb. Female adapters in driving head; male adapters on torque base.

Controlled (Torque) Drive Stud Driver

Predetermined amount of torque can be applied to stud during driving. Simply adjusted by two Allen screws in spring adjusting nut—downward, increased torque; upward, decreased torque. For use with any air or electric drill or drill press. Sizes #101—#102—#103.

"Bull Dog" Stud Driver Designed for Use With Impact Wrenches

Built for rugged use on heavy engines. Equipped with Titan Design, Loose Pressure Plunger. Definitely stands up under vibration encountered when using an impact wrench for motive power.

Titan "Roll Grip" Combination Stud Driver and Puller

Incorporates roll action to grip as little as ½ in. of unthreaded body of stud. Made in standard sizes from 3/16 to 3 in. inclusive.

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World's Largest Producers Of Stud Drivers And Pullers

TITAN TOOL CO.

47 MAIN ST., FAIRVIEW (ERIE COUNTY), PA.

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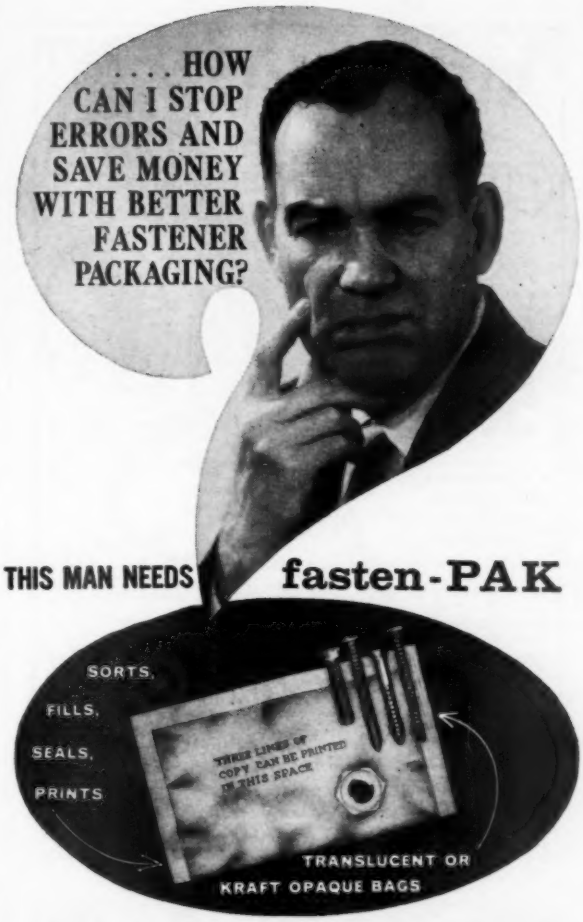
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Here is a new concept in packaging of assembly materials. fasten-PAK electronic packaging is less expensive than any other method now employed and when your materials are purchased from Mid-Continent Screw Products Company, your savings are doubled.

Here is what **fasten-PAK** does for you!

1. **fasten-PAK** will sort assembly materials in a multiple of sizes and assortment. It will package items in either translucent or kraft opaque bags completely enclosed. The package is printed, filled, and sealed in one operation.

2. Most assembly materials can be packaged by **fasten-PAK** process. Many of the items include: Wood Screws, Sheet Metal Screws, Machine Screws Square-Head Set Screws, Square Nuts, Hex Nuts, Cap Nuts, Wing Nuts, Round Nuts, Lag Bolts, Machine Bolts, Carriage Bolts, Washers, Cotter Pins, and Nails. We are not limited to types of metals ferrous or non-ferrous. Most sizes can be accommodated.

3. Each package may carry your own message, printed on the bag. Up to three lines of copy may be used to describe the contents and promote the quality of your product. This feature also eliminates any chance of error in packaging of proper materials.

for information contact:

MID-CONTINENT SCREW PRODUCTS CO.

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CUSHION GRIP
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Blisterproof—oil & water resistant Neoprene Rubber Grip permanently Locked into tough Amber Handle
Bolstered Blade winged shank for maximum strength
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Blade of high grade hardened alloy tool steel
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THE BRIDGEPORT HARDWARE MANUFACTURING CORPORATION BRIDGEPORT CONNECTICUT U S A

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He was formerly manager of Plastics Division and assistant sales manager. The chemical engineering graduate of the University of New Hampshire has been with the company since 1955.

PATLOVICH JOINS AMERICAN SEALANTS

The appointment of Ted Patlovich as representative for American Sealants Company, Hartford, Conn., in New Jersey, Eastern Pennsylvania, Delaware and Maryland area was announced by Robert Krieble, vice president and and general manager.

Patlovich will offer technical and engineering service regarding Loctite Sealant, a new liquid plastic material. He graduated from Springfield College with a B.S. degree in 1950.

OWATONNA TOOL ADDS SALES ENGINEER

Francis J. Pauler has joined the staff of Owatonna Tool Co., Owatonna, Minn., as a sales engineer. He was previously a service engineer at Wright Tool Co., Royal Oak, Mich.

PATTON NEW DIRECTOR AT CLEVELAND CAP

John P. G. Patton has been elected secretary and a member of the board of directors of The Cleveland Cap Screw Company, Cleveland.

The registered professional engineer (Pa.) joined Standard Pressed Steel Co., Jenkintown, Pa., in 1956 as assistant production control manager. In 1957 he moved to Cleveland Cap as production control manager. In his new Cleveland post, Patton also will serve as manager of operations.

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Lock tight with just a quarter turn!

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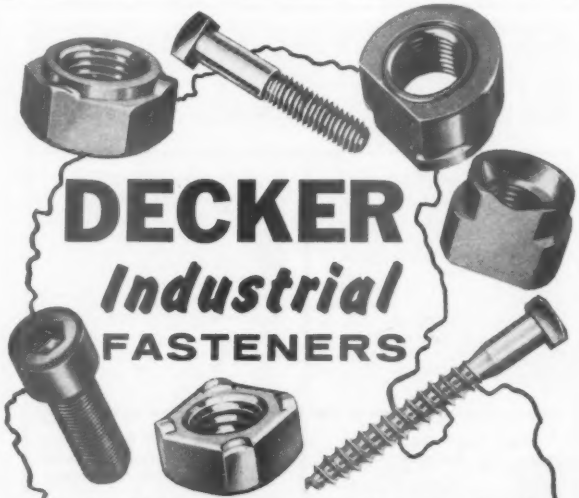

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Study your production applications now and see for yourself how many ways Decker Fasteners can save your assembly time and dollars. Decker is ready to serve you—any quantity, type or size.

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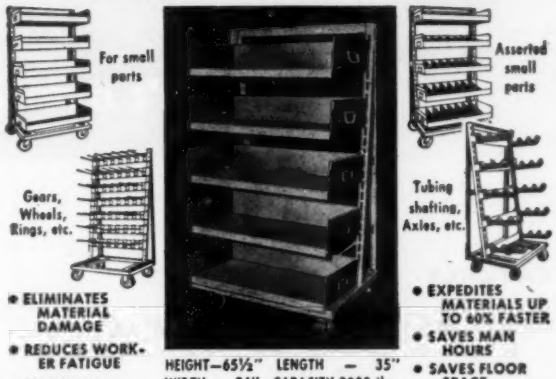
THE ACME OF VERSATILITY



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SCREWS AND NUTS AUTOMATICALLY DRIVEN WITH PRECISE TORQUE CONTROL

Gives you . . .

1. Complete control of screws from parts feeder to chuck, until threads are started. No dependence on gravity to load chuck.
2. Exclusive built-in sensing, assures that screw is driven. Automatically retracts driver only after attaining proper torque.
3. Complete automatic cycle, requires only a touch of the pedal.
4. Torque accuracy within 5%, comparable to most precise hand-torquing methods.
5. Clutch free-wheels after driving. Operator cannot vary the torque.
6. Two ranges of torque available 0 to 84 inch-pounds and 48 to 120.
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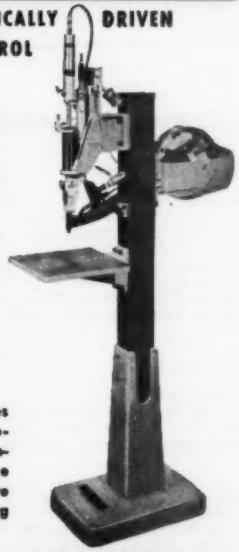

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Full information available in bulletin No. SD-81.

Model SD-100, above, tooled for any standard screw up to ¼" thread size. Special tooled units with multiple feeders available. Model SD-101, without floor column, provides a complete automatic station. Maximum width 6 inches.

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31—Trouble-Shooting Fastening in Plastics

A push-on clip solves the problem of plastic radio panel fracture during assembly.

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ONE LAST WORD

WE CARRY TREASURES IN IMPERFECT VESSELS

The application of this thought is universal. It embraces all mankind and all his institutions. Yet, too often we do not differentiate between the treasure and the vessel which carries the treasure. Each of us, at one time or another, has involved himself with judging the Spirit of the Thing by the vessel which carries, or the cloak which garbs it.

The recent national political conventions are but an example. Within this framework rambled the ideas of Liberty and Freedom. In this most imperfect spectacle was mirrored the concept of Democracy. Small wonder that many foreigners, who do not draw a fine distinction between the central truth and its external trappings, shake their heads and wonder how democracy can possibly operate under the guidance of children and charlatans. Yet, even these cracked performances could not hide the treasure: free men determining their destiny and the destiny of millions in an open assembly created for this purpose. The performance may have been strained, the vehicle cracked and the entire operation lame, but who can deny the glowing, healthy spirit of liberty which shone through the shortcomings?

So many of us are not yet aware of the thin line which divides liberty from slavery. As from love to hate, so from freedom to bondage is but a quick step. We do not marvel at this treasure enough, nor thank God enough for it. But we are so much concerned with the jangles and the frequent idiocy of it, that we confuse that which is perfect and fine with the dull and chipped implementation of it.

It is also so with religion. The church is but the imperfect vessel which carries the treasure of God and life everlasting. And if the vessel be not made of gold but is earthen and cracked, is the treasure the less beautiful and holy?

Isn't it a stunning revelation and a continuing wonder that a frail collection of bones and blood could have produced a Hamlet, or written a symphony, or done the Mona Lisa? This most imperfect vessel of all, the human body, carries a treasure, a divine and holy spark, that all its deficiencies and all its frailties cannot hide nor its meager physical life on earth can bury.

And on a more individual level this holds true for all of us. We carry treasures about with us, sometimes buried so deep it appears as though we had none, so hidden in crevices and crannies that we are unaware of them: The treasures of Liberty, of Life, of Soul, of Spirit. Some scorn them; others deny them. Many are concerned with the body which houses them. Would we not do well to be more aware of the treasures and more tolerant and understanding of the imperfect vessel?

Wm. F. Schleicher

Vice President & Editorial Director

How versatile can one fastener be?

SEL-LOK spring pins can replace cotter pins, keys, axles, hinge pins, wrist pins, stop pins, pivots

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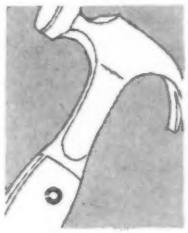
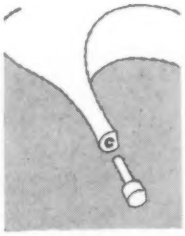


Tool handle



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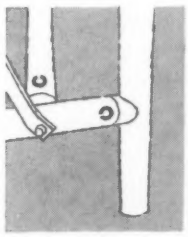
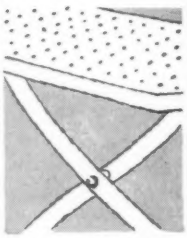
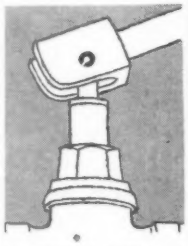


Metal table legs

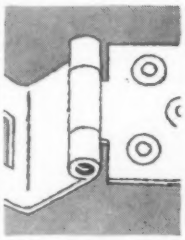
AS HINGE PIN



In leg-joint of
ironing board

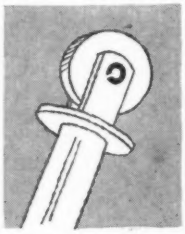


On valve handle

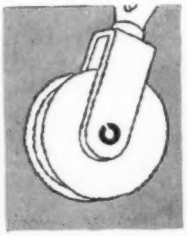


In hinge

AS AXLE



In cigarette lighter



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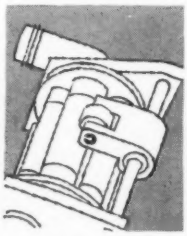

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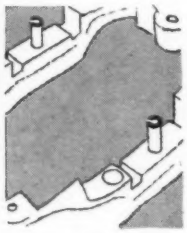

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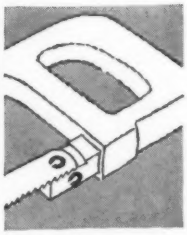

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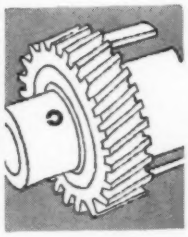

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in assembly

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